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Volume II: Appendices

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SYNOPTIC SURVEY OF CHLORINATED HYDROCARBON INPUTS TO THE SOUTHERN CALIFORNIA BIGHT

VOLUME II APPENDICES

by

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SECTION XVI

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APPENDIX A

ANALYTICAL PROCEDURES

In the first part of this appendix we describe the procedures presently used in our laboratory for the analysis of chlorinated hydrocarbons in all the categories of marine samples discussed in this report. Following the section on confirmation of chlorobenzene concentrations by mass spectrometry, we present information which illustrates the accuracy and precision of our procedures as they have been developed over the past three years. Additional results dealing with this subject are presented in Appendix G.

PRESENT ANALYTICAL PROCEDURES

Preparation

All glassware used for chlorinated hydrocarbon analysis is washed with soap and water. The glassware is then heated in a kiln at 535°C for 4 hours to volatilize any compounds that might interfere with the analysis from its surfaces. All solvents used in the analysis are pesticide quality.

Municipal and Industrial Wastewaters and Surface Runoff

The samples, which are preserved in 75 ml/l of 15 percent (by volume) diethyl ether in hexane, are placed in a graduated cylinder and measured and then transfered to a separatory funnel (500-ml, or 2-liter for larger samples) equipped with a teflon stopcock. The separatory funnel is shaken for 2 minutes and the layers are allowed to separate. The aqueous layer is drained into a beaker, and the organic layer is placed in a round-bottomed flask; the aqueous layer is then returned to the separatory funnel and covered with 6 percent diethyl ether in hexane. The separatory funnel is again shaken for 2 minutes; the resulting organic layer is combined with the first organic layer in the round-bottomed flask. The aqueous portion is then extracted a third time with pure hexane. The flask with the organic layers is then attached to a Rotovapor (Rinco Instrument Co., Inc., Greenville, Ill.), and the volume is reduced to about 25 ml. The extracts are cleaned on a Florisil column before injection into a gas chromatograph.

Since 1974, the municipal wastewater extracts have routinely been split and one-half "saponified" in the manner described later in this appendix. If necessary, other water sample extracts are also saponified.

Paint

Most wet paint samples are extracted using a separatory funnel. A measured volume of the paint is pipetted into a 500-ml separatory funnel containing 100 ml of 15 percent diethyl ether in hexane (by volume). If the paint seems to disperse easily when dropped into the ether/hexane mixture, the separatory funnel method of extraction is employed. On the other hand, if the wet paint sample forms a seemingly nonpermeable drop or plastic-like string, the samples are extracted using the Soxhlet method.

Separatory Funnel Method

The separatory funnel containing the ether/hexane mixture and the sample is shaken for 2 minutes. The sample is then allowed to settle to the bottom of the separatory funnel, and the extract is carefully decanted into a round-bottomed flask. This procedure is repeated two times, first with the addition of 100 ml 6 percent diethyl ether in hexane and then with the addition of 100 ml of hexane. In both cases, the settled extract is decanted into the round-bottomed flask. The flask is then attached to the Rotovapor and reduced to a volume suitable for a Florisil cleanup.

Soxhlet Extraction Method

This method is used on dry paint samples and on wet paints that do not disperse easily when dropped into an ether/hexane mixture (the wet paint to be Soxhlet-extracted is first spread on aluminum foil and dried).

Before a sample is extracted, the thimbles and hexane are added to the Soxhlet extraction apparatus, and the hexane is refluxed for a period of 2 hours to clean the apparatus. The rinse hexane is then removed and replaced with clean hexane, and the samples are weighed into the cleaned thimbles. The Soxhlets are then refluxed for an 18-hour period, and the extracts are concentrated in a Rotovapor to a volume suitable for Florisil cleanup.

Aerial Fallout

Aerial fallout samples are first processed through a "cleanup" column before being analyzed by gas chromatography. The column consists of a disposable 5-ml pipet (8 mm OD, 6 mm ID), which is packed with specially prepared and activated silica gel. (MCB Silica Gel (SX-144-6), 100/200 mesh, is used. The gel is washed with a 1:1 solution of methanolbenzene; 3-ml of solution are used per 1 g of adsorbent. After rinsing, the silica gel is dried in a Rotovapor and activated at 180°C overnight. It is then stored under hexane until use).

The column is packed by inserting a plug of silane-treated glass wool, adding several milliliters of hexane, and slurrying the silica gel with a pipet. Using the markings on the 5-ml pipet as guide, adsorbent is added until the volume of the compacted bed is 1.7 ml ± 0.1 ml. A vibrator is then held against the column briefly to compact the adsorbent.

The fallout samples come into the laboratory in centrifuge tubes containing up to 1 ml of mineral oil. The sides of the tube are first washed down with enough hexane to bring the volume to 3 ml. The sample is then transfered from the centrifuge tube to the column using a pipet. An initial elution of 1.7 ml hexane is used to remove the mineral oil from the column; this fraction is discarded. The column is then eluted with 5.7 ml of 20 percent benzene in hexane (by volume), followed by 6 ml of benzene. The first fraction elutes the PCB and DDT compounds, and the second fraction elutes Dieldrin. Since fall 1974, the first fraction has been split, and one-half saponified for PCB determination.

Seawater

Chlorinated hydrocarbons are concentrated from the seawater samples on polyurethane foam contained in stainless steel columns. The columns are 33 cm long, 6.4 cm OD, and 6.0 cm ID. Stainless steel cross-hairs are welded into the column 23 cm from the end to prevent the plugs from passing through the column under vacuum. The polyurethane plugs (Stock No. 2064, United Foam Company, Los Angeles, Calif.) are 6.4 cm in diameter and 6.4 cm thick. The columns are cleaned before use with a wash of 500 ml of acetone, followed by 500 ml hexane. The hexane wash is then tested for impurities by gas chromatography. Just prior to sampling, the column is primed with 250 ml of ethyl alcohol.

The water samples collected from the sea surface are transfered to 4-liter glass beakers aboard ship and immediately passed through the column at a flow rate of 250 ml/min. until 40 liters of water have passed through the column. The excess water is removed from the columns by swinging them; they are then wrapped in aluminum foil and transported to the laboratory.

In the laboratory, the samples are extracted by eluting with 500 ml of acetone followed by 500 ml of hexane. The plugs are squeezed with a glass rod to remove the last portion of solvent. The solvent is then transfered to a 2-liter separatory funnel, and 500 ml of deionized water is added to the separatory funnel. The separatory funnel is shaken for 2 minutes, and the layers are allowed to separate; the organic layer is then transfered to a round-bottomed flask and concentrated to about 50 ml with a Rotovapor.

The sample is next put through a cleanup column. The column packing is made by mixing 17 g of Celite (J.T. Baker Co., E406) with 5 ml of concentrated sulfuric acid and 5 ml of fuming (30 percent free SO_3) sulfuric acid (J.T. Baker Co., 9705) in a beaker with a glass stirring rod; the packing is then covered with hexane. The mixture is packed into a Buckner funnel with fritted glass of medium porosity with a diameter of 7.6 cm and tamped down; the excess solvent is removed with an aspirator. The sample is then placed on the column, where it passes through into a receiving flask. Next, the column is eluted with 75 ml of hexane. When the hexane has passed, another 75 ml portion of hexane is passed through the column. The column is then taken to dryness with the aspirator to remove the last portion of hexane. Half the sample is saponified for PCB determination. The sample fractions are then injected into the gas chromatograph.

Sediments

A sample is first dried in an oven at about 60°C. A Soxhlet extraction apparatus is used for the extraction. The dried sediment sample is weighed into a cellulose thimble and placed into the Soxhlet apparatus. The Soxhlet flask is charged with 200 ml of hexane, and the extraction is run for an 18-hour period. The extract is then cleaned up using a Florisil column, concentrated, and injected into the gas chromatograph.

Tissues

The tissue sample is first homogenized into a paste. About 10 g of each homogenate is weighed into a 150-ml beaker. The homogenate is then covered with 20 ml of acetonitrile and ground with a high-speed blender for about 1 minute or until all pieces of the sample have been thoroughly ground. The blades of the blender are then rinsed twice with 20 ml of acetonitrile, and the rinse is added to the beaker containing the sample. The acetonitrile is then decanted and filtered through filter paper into a 500-ml separatory funnel with a ground-glass stopper. The sample is rinsed three times with 20 ml of acetonitrile and the rinse decanted and filtered into the 500 ml separatory funnel with the other acetonitrile fraction. Fifty milliliters of hexane is added to the funnel, and it is shaken vigorously for a period of 1 minute. The two layers are allowed to separate (the hexane layer is less dense than the acetonitrile layer). The acetonitrile layer is then drained through the stopcock into a 400 ml beaker, and the hexane layer is emptied into a 250 ml flask. The acetonitrile fraction is returned to the separatory funnel and extracted two more times with 50 ml of hexane. The hexane extracts are all combined into the 250 ml flask and concentrated to about 50 ml with the Rotovapor. The samples are cleaned up on a Florisil column prior to concentration and injection.

Air Samples

Air samples are collected using a Misco high volume air sampler (Model 680) equipped with a Model 810P filter head assembly. The filter head was remodeled so that the air passes first through an 8" x 10" piece of Gelman A glass fiber filter and then through a series of five polyurethane foam pads (½" thick). Most of the particulates in the air are removed by the glass fiber filter and the foam pads trap the chlorinated hydrocarbons in the vapor phase.

The foam pads are cleaned before sampling and extracted after sampling by using the extraction procedure described above for seawater sampling (the pads are rolled up loosely and inserted into a stainless steel seawater sampling column for cleaning and extracting). The cleanup procedure also is identical to that used for the seawater samples.

Saponification (Dehydrohalogenation)

A sample extract (reduced in volume to about 40 ml) is measured into a 250 ml Erlenmeyer flask equipped with a standard tapper ground-glass joint. Five grams of KOH are dissolved in water and diluted to 50 ml with ethanol. This mixture is added to the Erlenmeyer. The sample is then fitted with a three-ball Snyder condenser, and the mixture is placed on a steam table and refluxed for 30 minutes after it begins to boil. The contents of the Erlenmeyer are placed in a 500 ml separatory funnel along with 100 ml of deionized water and 50 ml of hexane. The separatory funnel is then shaken for 5 minutes and the layers allowed to separate. The lower aqueous layer is discarded, and the organic layer is washed with two 100-ml portions of water. The saponified sample is then concentrated and injected into the gas chromatograph.

Florisil Cleanup

Activation of the Florisil (MCB, FX284) is carried out at 705°C using a pottery kiln. The Florisil is placed in 250 ml covered crucibles in the kiln and baked for 4 hours. The activated Florisil is stored under hexane until use.

To clean a sample, 8 cm of the slurried-activated Florisil is added to the cleanup chromatographic columns (25 mm OD, 22 mm ID, and 400 mm in length, with sealed-in, coarse porosity fritted disc; Kontes Glass Co., Vineland, N.J.), and 1 cm of anhydrous sodium sulfate is added over the Florisil. Samples are concentrated to a volume of approximately 50 ml and added to the Florisil column. The column is eluted with 45 ml of 6 percent diethyl ether in hexane. If Dieldrin is also to be measured, the receiving flask is changed and the column is eluted again with 100 ml of 15 percent diethyl ether in hexane.

Instrumentation and Quantitation

Samples are injected into a Tracer MT-220 gas chromatograph equipped with a ^{63}Ni detector. The glass column is 6 ft. long, 6 mm OD, and 2 mm ID and packed with 1.5 percent OV-17 + 1.95 percent QF-1 on 80/100 mesh Gas Chrom Q (Applied Science). The carrier gas is prepurified nitrogen with a flow rate of 20 ml/min through the column and 60 ml/min purge through the detector. For pesticides and PCB's the injector, column, and detector temperatures are 225, 200, and 285°C, respectively. For hexachlorobenzene the injector, column, and detector temperatures are 225, 150, and 285°C, respectively. For ortho- and para-dichlorobenzene and 1,2,4- and 1,3,5-trichlorobenzene the injector, column, and detector temperatures are 225, 75, and 285°C, respectively. The components are identified by retention time and quantitated by comparing the peak heights of the samples with the peak heights of standards.

Mass Spectrometry Confirmation of Chlorinated Benzenes

Intercalibration samples extracted by the Project laboratory for chlorinated benzene analysis were sealed in glass ampoules and sent to California Analytical Laboratories, Inc., in Sacramento.

A Finnigan 1015D gas chromatograph - mass spectrometer with a PROMIM programmable multiple ion monitor was used in this study. Either a 1.5m x 2mm glass column (packed with 3% OV-1 on 100-200 mesh Gas Chrom Q) or a 3m x 0.25 mm glass capillary column coated with SE-30 was used for these analyses. The di- and trichlorobenzenes were chromatographed at 160^{o} on the 3% OV-1 column.

The confirmation of the chlorobenzenes is based upon retention time and the detection of the molecular ions of the compounds, as well as full mass spectra when possible.

DEVELOPMENT OF ANALYTICAL PROCEDURES

Determination of Instrumental Linear Range

When comparing signals from sample and standard solutions, it is important to operate within the linear range of the instrument whenever possible to minimize analytical error. Thus, to initially determine the operating conditions for our Tracor MT-220 gas chromatograph which would insure linearity, uncalibrated stock solutions of p,p'-DDT and p,p'-DDE were diluted to a number of different concentrations and injected into the chromatograph using several combinations of range and attenuation settings. The results of this experiment indicated that, at a range setting of 10 and an attenuation setting of 32, a linear relationship (± 10 percent) between quantity of standard injected and resultant peak height exists over the full extent of recorder readout. Therefore, these have been selected as the optimum settings for our analyses. During a measurement, injection volumes for samples and standards are adjusted as necessary so that the detector response indicated by the chromatogram reading stays within the range known to be linear. Reinjections of altered dilutions are continued until all major peaks of interest lie within the linear range.

Development of Extraction Procedure

Extraction recovery tests, based on addition of relatively large amounts of chlorinated hydrocarbon standards to samples generally are not considered to be realistic. Thus, a storm runoff sample (#100) collected from Los Angeles River on February 28, 1973 was selected to be extracted and processed fraction by fraction. The four fractions were as follows: (1) 353 ml of 15 percent diethyl ether in hexane; (2) 200 ml of 6 percent diethyl ether in hexane; (3) 200 ml of hexane; and (4) 200 ml of hexane. Successively, each fraction was shaken with the sample for a period of two minutes, and processed according to the standard procedure. The results of this experiment are listed in Table A-1. These data indicate that the fourth extraction contained a negligible percentage of the total quantity of each chlorinated hydrocarbon measured in the four fractions. Therefore, the resulting extraction procedure includes only the first three fractions, and it is assumed that 100 percent of all compounds of interest are extracted in these first three fractions.

Development of Cleanup Procedure

The following cleanup procedure using activated Florisil was developed, including a two-step elution which satisfactorily accomplished a separation of Dieldrin from the DDT compounds. This step was determined to be necessary because of similar retention times of Dieldrin and p,p'-DDE on some of the gas chromatograph standard columns used in this laboratory.

TABLE A-1
Concentrations of chlorinated hydrocarbons (μg/l) of original sample measured in four successive extracts of storm runoff sample #100.

Compound	Extract					
First Elution**	1st	2nd	3rd	4th	Sum*	$\frac{\text{4th}}{\text{Sum}}$(%)
1242 PCB	9.18	1.32	0.24	0.15	10.89	1.4
1254 PCB	1.83	0.15	0.07	0.06	2.11	2.8
p,p'-DDT	0.564	0.052	0.016	0.012	0.644	1.9
o,p'-DDT	0.436	0.047	0.016	0.009	0.508	1.8
p,p'-DDE	0.116	0.011	0.001	ND	0.128	-
p,p'-DDD	0.018	ND	ND	ND	0.018	-
Second Elution^{+}						
Dieldrin	0.175	0.021	0.006	0.004	0.206	1.9

*This sum is not the final concentrations reported for this sample. The reported values are based on a composite of these four fractions and subsequent saponification.

**The first elution from the Florisil column is 45 ml of 6% diethyl ether in hexane.

$^{+}$The second elution from the Florisil column is 100 ml of 15% diethyl ether in hexane.

The Florisil was first activated as described above. Eight cm of the slurried activated Florisil were than added to the cleanup chromatographic columns (25 mm OD, 22 mm ID, 400 mm length, with sealed-in coarse porosity fritted disc, Kontes Glass Co., Vineland, N.J.), and 1 cm of anhydrous sodium sulfate was added over the Florisil. Samples were concentrated to a volume of approximately 50 ml and added to the Florisil column. The column was eluted with 45 ml of 6 percent diethyl ether in hexane for the first fraction collected and 100 ml of 15 percent diethyl ether in hexane for the second fraction.

The results of a Florisil recovery study conducted with four replicates are presented in Table A-2. These data indicate that the double elution procedure provides good chemical separation

TABLE A-2
Percentages of chlorinated hydrocarbon standards (added to blank extraction solutions) which are recovered from the Florisil column cleanup procedure.

Compound	Percent Recovery					
	R-1	R-2	R-3	R-4	Average	± $S\bar{x}$
First Elution						
1242 PCB	106	107	108	103	106	1
1254 PCB	96	89	99	94	95	2
p,p'-DDT	102	93	111	103	102	4
o,p'-DDT	93	110	101	99	101	4
p,p'-DDE	94	100	102	94	98	2
o,p'-DDE	102	95	86	95	94	3
p,p'-DDD	84	102	84	86	89	4
Dieldrin	<3.5	<3.5	<3.5	<3.5	<3.5	0
Aldrin	99	92	113	103	102	4
Heptachlor*	74	82	91	95	86	5
Heptachlor epoxide	35	26	20	26	27	3
Second Elution						
Dieldrin	93	93	82	93	90	3
Endrin	104	114	96	91	101	5
Heltachlor epoxide	66	70	77	68	70	2

*Attempts to measure heptachlor concentrations have been discontinued owing to discovery of significant solvent interferences.

of Dieldrin from p,p'-DDE, with which it interferes on the chromatogram. In light of the fact that these two compounds generally have been found to occur in approximately the same concentrations in the runoff samples, this degree of separation into the two eluants appears to be quite adequate. The data in Table A-2 indicate that the extraction efficiencies for the major compounds are not significantly different from 100 percent, and losses incurred during the concentration step (described below) have been shown to be negligible.

Recovery of "Kuderna-Danish" Concentration

For reducing sample volumes, a Kuderna-Danish concentrator with a three ball Synder condenser is used. As it is sometimes necessary that samples be reduced to very small volumes on a steam bath using this apparatus, an examination of the recovery of each component of interest was undertaken. Dilute standards were transferred into the Kuderna-Danish concentrators with 100 ml of hexane and about 30 ml of 6 percent diethyl ether in hexane. The concentrators were fitted with three ball Snyder condensers and placed on a steam table. The samples were reduced in volume to about 10 ml. The samples were then transferred to a graduated cylinder and the Kuderna-Danish concentrators were washed three times with about 2 ml of hexane. The wash was added to the graduated cylinders. Table A-3 presents the percent recovery values obtained. Nearly 100 percent recovery was observed in every case with the exception of heptachlor, which in any case cannot be measured in samples due to solvent interferences. Although the only PCB tested was Arochlor 1242, the other PCB's of interest (1254 and 1260) are of higher molecular weight and therefore less volatile; thus, these recoveries were also assumed to be 100 percent.

Saponification of Pesticide Extracts

A procedure for saponification of pesticide extracts was tested to confirm measurements of PCB concentrations in the various classes of samples under investigation. The reaction of alcoholic potassium hydroxide with some pesticide residues (saponification) leaves the PCB's untouched and converts DDT and DDD compounds to ethylene derivatives. When samples are run, the chromatograms of saponified and unsaponified fractions are compared so that the amount of PCB interference may be subtracted from the pesticide peaks and the pesticide values therefore may be calculated with increased confidence from the remainder of the peak height. Also, the PCB profile may be viewed more clearly so that the PCB's may be confirmed. From the data in Table A-4 it can be seen that both p,p'-DDT and o,p'-DDT, as well as p,p'-DDD, are largely converted. Also, it may be seen that the PCB compounds are essentially untouched by the process.

The necessity of including the saponification step in the analytical procedure for all surface runoff samples was examined in consider-

TABLE A-3

Percent recoveries of diluted chlorinated hydrocarbon standards obtained from the Kuderna-Danish concentration procedures.

Compound	Percent Recovery					
	R-1	R-2	R-3	Average	±	S$\bar{X}$
1242 PCB	94	103	103	100		3
p,p'-DDT	98	99	99	99		1
o,p'-DDT	99	103	100	100		1
p,p'-DDE	100	98	101	100		1
o,p'-DDE	100	102	99	100		1
p,p'-DDD	94	96	97	96		1
Dieldrin	99	101	101	100		1
Aldrin	97	101	99	99		1
Endrin	96	106	107	103		4
Heptachlor	83	90	84	86		2
Heptachlor Epoxide	93	115	101	103		6

TABLE A-4

Percent recoveries of chlorinated hydrocarbon standards following saponification.

Compound	Percent Recovery				
	R-1	R-2	R-3	Average	± Sx̄
1242 PCB	98	97	95	97	1
1254 PCB	99	101	106	102	2
1260 PCB	104	105	101	103	1
p,p'-DDT	<1	<1	<1	<1	-
o,p'-DDT	<1	<1	<1	<1	-
p,p'-DDE	-	-	-	-	-
o,p'-DDE	-	-	-	-	-
p,p'-DDD	<1	<1	<1	<1	-
Dieldrin	84	75	-	80	5
Aldrin	89	85	-	87	2
Endrin	108	91	-	99	9
Heptachlor	65	33	-	49	16
Heptachlor epoxide	61	30	-	45	16

able detail. Early in the program eleven samples from the February 27 - March 1 storm were first analyzed for chlorinated hydrocarbon concentrations according to the usual procedure. These samples were then saponified and the resultant chromatograms compared quantitatively to the chromatograms obtained before saponification to obtain a second, "corrected" estimation of the concentrations. The corresponding values resulting from these two methods are listed in Table A-5. These data indicate that the time-consuming saponification step is not required for analysis of all surface runoff samples.

Confirmation on an Alternate Column

Extracts from representative samples of surface runoff and aerial fallout were confirmed on different columns. The sample extracts were prepared according to the usual procedures and analyzed using 3 percent OV-1 on 100/120 Chromosorb HP, AW, DMCS (Column 1). The columns used for confirmation were Column 2: 5.5 percent OV-17 and 5.5 percent QF-1 on Gas Chrom Q; or Column 3: 3 percent QF-1 on Gas Chrom Q. The results are compared in Tables A-6, A-7, and A-8. The comparisons indicate quite satisfactory agreement between results yielded by the column-pairs for the runoff and fallout samples studied.

TABLE A-5

Comparison of chlorinated hydrocarbon concentrations (µg/l) in Los Angeles River runoff (Storm Series No. 2: Feb. 27 to March 1, 1973) as calculated both for non-saponified (NS) and for saponified (S) samples.

SCCWRP No.		Chlorinated Hydrocarbon Compound			
		1242*	1254	p,p'-DDT	p,p'-DDD
100	NS	9.6	2.0	0.67	0.04
	S	9.5	1.9	0.68	0.08
102**	NS	0.32	0.21	0.20	–
	S	0.27	0.18	0.16	–
103**	NS	0.26	0.20	0.18	–
	S	0.23	0.19	0.14	–
105	NS	0.60	0.26	0.01	0.02
	S	0.65	0.23	0.01	0.03
108	NS	1.47	1.08	1.76	0.65
	S	1.12	1.12	1.69	0.65
110	NS	0.55	0.36	0.53	0.13
	S	0.53	0.42	0.53	0.16
112	NS	0.57	0.35	0.57	0.07
	S	0.60	0.50	0.56	0.07
114	NS	0.47	0.26	0.38	0.04
	S	0.37	0.27	0.38	0.05
116	NS	0.37	0.23	0.29	0.09
	S	0.31	0.29	0.27	0.10
118	NS	0.26	0.16	0.08	0.02
	S	0.24	0.15	0.07	0.02
120	NS	0.10	0.08	0.02	0.01
	S	0.06	0.10	0.01	0.01
168+	NS	0.05	<0.01	<0.001	<0.001
	S	0.05	<0.01	<0.001	<0.001

* 1242 PCB concentrations generally are upper limits only.

** Samples Nos. 102 and 103 are replicate 3-liter collections of Los Angeles River storm runoff: 2/28/73, 1815.

+ Process Blank.

TABLE A-6

Comparison of chlorinated hydrocarbon concentrations (µg/l) in three surface runoff samples (Nos. 100, 102, and 103) as measured on different gas chromatograph columns. Column 1: 3% OV-1 on Chromosorb W, HP; Column 2: 5.5% OV-17 and 5.5% QF-1 on Gas Chrom Q.

Compound	No.100		No.102*		No.103*	
	Col.1	Col.2	Col.1	Col.2	Col.1	Col.2
1242 PCB	9.6	8.4	0.32	0.49	0.26	0.42
1254 PCB	2.0	1.6	0.21	0.25	0.20	0.25
Total PCB	11.6	10.0	0.53	0.74	0.46	0.67
p,p'-DDT	0.68	0.57	0.16	0.12	0.14	0.09
o,p'-DDT	0.46	0.19	0.08	0.04	0.08	0.04
p,p'-DDE	0.17	0.18	0.05	0.04	0.05	0.03
p,p'-DDD	0.08	0.22	-	0.05	-	0.05
Total DDT	1.39	1.16	0.29	0.25	0.27	0.21
Dieldrin	0.21	0.18**	0.06	-	0.05	-

*Runoff samples No. 102 and No. 103 are replicate collections.

**Dieldrin fraction confirmed during separate experiment on Column 3: 3% QF-1 on Gas Chrom Q. See Table A-7.

TABLE A-7

Comparison of dieldrin concentrations (µg/l of original sample) in four successive extracts of surface runoff sample No. 100, measured on different gas chromatographic columns (Column 1: 3% OV-1 on Chromosorb W, HP; Column 2: 3% QF-1 on Gas Chrom Q).

1st		2nd		3rd		4th		Sum	
Col.1	Col.2	Col.1	Col.2	Col.1	Col.2	Col.1	Col.2	Col.1	Col.2
0.175	0.152	0.021	0.020	0.006	0.005	0.004	0.004	0.206	0.181

TABLE A-8

Comparison of chlorinated hydrocarbon flux values (10^{-7} g/m^2-day) from a trial aerial fallout sample as measured on two different gas chromatograph columns. (Col. 1: 3% OV-1 on Chromosorb W, HP; Col. 2: 5.5% OV-17 + 5.5% QF-1 on Gas Chrom Q).

Compound	Flux onto Trial Sample = 10^{-7}g/m^2-day	
	Column 1	Column 2
1242 PCB	10.6	16.3
1254 PCB	4.6	6.4
Total PCB	15.2	22.7
p,p'-DDT	7.6	7.3
o,p'-DDT	1.5	1.0
p,p'-DDE	0.3	0.6
p,p'-DDD	-	0.5
Total DDT	9.4	9.4

APPENDIX B

MUNICIPAL WASTEWATERS

Introduction

The following tables present detailed results of our analyses of chlorinated hydrocarbons in municipal wastewaters discharged to the Southern California Bight. Table B-1 through B-4 summarizes our best annual estimates of representative concentrations and mass emission rates for total DDT, Dieldrin, 1242 PCB and 1254 PCB released via the major outfall systems. Table B-5 presents CSDLAC monitoring data for total DDT used to obtain the estimated JWPCP emissions. Subsequent tables present results from our extensive intercalibration exercises, and from other analyses of individual municipal wastewater composites, used to obtain the representative values above.

TABLE B-1

Representative concentrations and mass emission rates of total DDT from municipal waste dischargers, 1972-75.

	1972			1973			1974			1975		
	Flow (mgd)	Conc. (µg/l)	MER (kg/yr)	Flow (mgd)	Conc. (µg/l)	MER (kg/yr)	Flow (mgd)	Conc. (µg/l)	MER (kg/yr)	Flow (mgd)	Conc. (µg/l)	MER (kg/yr)
JWPCP	351	13*	6,300	359	7.5	3,720	347	3.0	1,440	341	2.3	1,080
Hyperion 5-mile	330	0.21	96	339	0.12	56	341	0.12	56	345	0.07	32
Hyperion 7-mile	4.6	5.0	32	4.8	1.4	9.3	4.7	2.6	17	4.3	3.0	18
OCSD	150	0.36	74	152	0.04	8.4	171	0.17	40	176	0.04	9.7
Pt. Loma	95	0.26	34	100	0.18	25	104	0.10	14	109	0.09	13
Oxnard	10	0.16	2.2	12	0.48	7.9	10	0.28	3.9	9.5	0.10	1.2
Total	941		6,540	967		3,830	978		1,570	985		1,150

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* Mean concentration and MER for 1971: 42 µg/l; 21,600 kg/yr

TABLE B-2

Representative concentrations and mass emission rates of Dieldrin from municipal waste dischargers, 1972-1974.

	1972			1973*			1974		
	Flow (mgd)	Conc. (µg/l)	MER (kg/yr)	Flow (mgd)	Conc. (µg/l)	MER (kg/yr)	Flow (mgd)	Conc. (µg/l)	MER (kg/yr)
JWPCP	351	0.14	68	359	≤0.35	≤173	347	0.04	19
Hyperion 5-mile	330	0.03	14	339	≤0.07	≤ 33	341	0.03	14
Hyperion 7-mile	4.6	1.4	8.9	4.8	≤4.2	≤28	4.7	0.23	1.6
OCSD	150	0.03	6.2	152	≤0.14	≤ 29	171	0.25	59
Pt. Loma	95	0.02	2.6	100	≤0.09	≤12	104	0.01	1.4
Oxnard	10	0.01	0.1	12	≤0.01	≤ 0.2	10	0.004	0.06
Total	941		100	967		≤275	978		95

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* These values are probably upper limits due to the possibility of incomplete separation from interfering compounds

TABLE B-3

Representative concentrations and mass emission rates of 1242 PCB from municipal waste dischargers, 1972-1975.

	1972			1973			1974			1975		
	Flow (mgd)	Conc. (µg/l)	MER (kg/yr)	Flow (mgd)	Conc. (µg/l)	MER (kg/yr)	Flow. (mgd)	Conc. (µg/l)	MER (kg/yr)	Flow (mgd)	Conc. (ug/l)	MER (kg/yr)
JWPCP	351	24	11,600	359	3.8	1,880	347	1.9	910	341	0.97	456
Hyperion 5-mile	330	ND*	-	339	ND	-	341	0.11	52	345	0.16	76
Hyperion 7-mile	4.6	280	1,780	4.8	ND	-	4.7	72	467	4.3	20	120
OCSD	150	28	5,800	152	ND	-	171	8.1	1,910	176	6.5	1,580
Pt. Loma	95	ND	-	100	ND	-	104	6.7	960	109	1.1	167
Oxnard	10	ND	-	12	ND	-	10	0.1	1.4	9.5	0.08	0.9
Total	941		≥19,200	967		≥1,880	978		4,300	985		2,400

*ND=Not Detected

TABLE B-4

Representative concentrations and mass emission rates of 1254 PCB from municipal waste dischargers, 1972-1975.

	1972			1973			1974			1975		
	Flow (mgd)	Conc. (μg/l)	MER (kg/yr)	Flow (mgd)	Conc. (μg/l)	MER (kg/yr)	Flow (mgd)	Conc. (μg/l)	MER (kg/yr)	Flow (mgd)	Conc. (ug/l)	MER (kg/yr)
JWPCP	351	ND*	-	359	1.6	793	347	0.76	364	341	0.41	193
Hyperion 5-mile	330	0.3	137	339	0.38	178	341	0.24	113	345	0.18	86
Hyperion 7-mile	4.6	ND	-	4.8	26	172	4.7	50	324	4.3	20	119
OCSD	150	ND	-	152	1.4	294	171	0.90	210	176	0.79	192
Pt. Loma	95	0.9**	118	100	0.48	66	104	0.74	106	109	0.53	80
Oxnard	10	0.2	2.8	12	0.35	5.8	10	0.24	3.3	9.5	0.21	2.6
Total	941		≥258	967		1,510	978		1,120	985		673

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* Not detected

**Characterized as 1260 PCB

TABLE B-5

Mean monthly total DDT concentrations (µg/l) obtained from County Sanitation Districts of Los Angeles monitoring data for 1-week composites of JWPCP final effluent*, January 1971 - December 1975.

	1971	1972	1973	1974	1975
January	39.0	11.7	7.33	3.78	2.20
February	30.9	17.2	4.79	3.62	2.19
March	107	18.6	6.08	2.61	2.96
April	70.5	14.5	10.3	2.69	2.37
May	63.0	22.3	8.78	2.02	1.90
June	69.0	13.0	9.42	2.31	2.10
July	52.7	10.7	8.45	2.47	1.74
August	21.4	11.1	13.4	3.62	2.21
September	13.6	9.68	9.22	4.08	2.46
October	13.6	8.05	5.22	2.78	1.86
November	10.0	15.2	2.81	3.10	2.34
December	9.28	6.89	4.17	3.08	3.59

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* Simulated final effluent samples used from January 1971 to December 1974

TABLE B-6

Concentrations (µg/l) of chlorinated hydrocarbons measured at Bodega Marine Laboratory in final effluents from the major treatment plants discharging municipal wastewater to the Southern California Bight, 1972.

Discharger and Collection Period		p,p'-DDT	p,p'-DDE	p,p'-DDD	Dieldrin	PCB*	
JWPCP	R-1	0.23	4.0	6.5	0.23	26	(1242)
Mar. 31- Apr. 7	R-2	0.17	3.2	5.0	0.06	21	(1242)
	Ave.	0.20	3.6	5.8	0.14	24	
Hyperion - 5 mi.	R-1	0.19	0.056	-	0.032	0.33	(1254)
May 1-7	R-2	0.12	0.050	-	0.036	0.24	(1254)
	Ave.	0.16	0.053	-	0.034	0.28	
Hyperion - 7 mi.	R-1	-	4.6	-	1.9	283	(1242)
May 1-7	R-2	-	5.5	-	0.8	280	(1242)
	Ave.	-	5.0	-	1.4	282	
Orange Co.	R-1	0.18	0.18	-	0.044	28	(1242)
May 21-27	R-2	0.22	0.14	-	0.018	27	
	Ave.	0.20	0.16	-	0.031	28	
Point Loma	R-1	0.17	0.073	-	0.025	0.88	(1260)
Mar. 7-13	R-2	0.19	0.079	-	0.021	0.97	(1260)
	Ave.	0.18	0.076	-	0.023	0.92	
Oxnard	R-1	0.13	0.035	-	0.010	0.26	(1254)
May 22-29	R-2	0.11	0.040	-	0.015	0.16	(1254)
	Ave.	0.12	0.038	-	0.012	0.21	

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* The chromatogram PCB profile most closely resembled that of the PCB compound indicated in parentheses

TABLE B-7

Concentrations (µg/l) of chlorinated hydrocarbons measured at Bodega Marine Laboratory, University of California at Berkeley, and County Sanitation Districts of Los Angeles County in grab samples of JWPCP primary effluent (E3) collected March 17, 1971.

	BML				CSDLAC				
Compound	R-1*	R-2	R-3*	Ave	A-1*	A-2*	B-1	B-2	Ave
p,p'-DDT	6.2	5.6	6.7	6.2	6.8	6.8	4.9	4.8	5.8
o,p'-DDT	-	-	-	-	1.2	1.4	1.2	1.4	1.3
p,p'-DDE	18.0	16.6	18.1	17.6	12.9	13.0	12.9	13.0	13.0
o,p'-DDE	-	-	-	-	5.4	5.6	5.7	5.6	5.6
p,p'-DDD	19.5	18.4	20.2	19.4	19.2	18.5	31.0	19.9	22.2
o,p'-DDD	-	-	-	-	9.9	8.7	10.6	9.7	9.7
Total DDT	43.7	40.6	45.0	43.1	55.4	54.0	66.3	54.4	57.5
1254 PCB	2.9	3.1	2.8	2.9	-	-	-	-	-

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* Samples extracted immediately upon collection; Other replicates, two days later

TABLE B-8

Concentrations (µg/l) of chlorinated hydrocarbons measured at Bodega Marine Laboratory and County Sanitation Districts of Los Angeles County in 1-week composites of JWPCP simulated final effluent collected March 31 - April 7, 1972.

	BML			CSDLAC
Compound	R-1	R-2	Ave	
p,p'-DDT	0.23	0.17	0.20	1.0
o,p'-DDT	-	-	-	0.26
p,p'-DDE	4.0	3.2	3.6	3.0
o,p'-DDE	1.4	1.1	1.2	-
p,p'-DDD	6.5	5.0	5.8	8.5
o,p'-DDD	1.5	1.2	1.4	1.4
Total DDT	13.6	10.7	12.2	14.2
Dieldrin	0.23	0.06	0.14	0.17
1242 PCB	26	21	24	5.5
1254 PCB	-	-	-	-
Total PCB	26	21	24	5.5

TABLE B-9

Concentrations (µg/l) of chlorinated hydrocarbons measured at SCCWRP, Bodega Marine Laboratory, University of Washington, and County Sanitation Districts of Los Angeles County in 1-week composites of JWPCP simulated final effluent collected May 4-10, 1973.

Compound	SCCWRP			BML			Univ. of Washington			CSDLAC
	R-1	R-2	Ave	R-1	R-2	Ave	R-1	R-2	Ave	R-1
p,p'-DDT	0.28	0.30	0.29	0.29	0.28	0.28	-	-	-	0.36
o,p'-DDT	-	-	-	-	-	-	-	-	-	0.13
p,p'-DDE	5.3	5.7	5.5	4.1	4.0	4.0	4.4	4.4	4.4	2.9
o,p'-DDE	0.61	1.1	0.86	-	-	-	-	-	-	0.48
p,p'-DDD	3.6	3.6	3.6	2.4	2.4	2.4	1.9	1.8	1.8	2.0
o,p'-DDD	-	-	-	-	-	-	0.9	0.9	0.9	0.42
Total DDT	9.8	10.7	10.2	6.8	6.7	6.8	7.2	7.1	7.2	6.3
Dieldrin	0.39	0.27	0.33	-	-	-	-	-	-	0.06
1242 PCB	3.7*	4.1**	3.9	3.5	3.3	3.4	4.2	4.1	4.2	0.80
1254 PCB	1.4*	1.6**	1.5	-	-	-	1.9	1.8	1.8	0.42
Total PCB	5.1	5.7	5.4	3.5	3.3	3.4	6.1	5.9	6.0	1.2

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* PCB values based on saponification and analysis of SCCWRP extract at SCCWRP

** PCB values based on saponification and analysis of BOdega extract at SCCWRP

TABLE B-10

Concentrations (µg/l) of chlorinated hydrocarbons measured at SCCWRP and County Sanitation Districts of Los Angeles County in 1-week composites of JWPCP simulated final effluent collected July 6-13, 1973 and September 7-14, 1973.

	July 6-13, 1973				September 7-14, 1973			
	SCCWRP			CSDLAC	SCCWRP			CSDLAC
Compound	R-1	R-2	Ave	R-1	R-1	R-2	Ave	R-1
p,p'-DDT	0.12	0.22	0.17	-	-	0.069	0.034	0.14
o,p'-DDT	-	-	-	-	-	-	-	0.13
p,p'-DDE	3.8	3.9	3.8	1.91	2.2	2.2	2.2	1.46
o,p'-DDE	0.61	0.77	0.69	0.09	0.62	0.37	0.50	-
p,p'-DDD	3.6	3.8	3.7	2.23	2.0	1.8	1.9	2.96
o,p'-DDD	-	-	-	0.33	-	-	-	0.92
Total DDT	8.1	8.7	8.4	4.56	4.8	4.4	4.6	5.61
Dieldrin	0.24	0.30	0.27	-	0.22	0.68	0.45	0.07
1242 PCB	-	-	-	-	-	-	-	-
1254 PCB	2.0	1.2	1.6	1.32	1.6	1.6	1.6	1.37
Total PCB	2.0	1.2	1.6	1.32	1.6	1.6	1.6	1.37

TABLE B-11

Concentrations (μg/l) of chlorinated hydrocarbons measured at SCCWRP and County Sanitation Districts of Los Angeles County in 1-week composites of JWPCP simulated final effluent collected May 10-17, 1974.

Compound	SCCWRP			CSDLAC
	R-1	R-2	Ave	R-1
p,p'-DDT	0.15	0.18	0.16	<0.01
o,p'-DDT	0.10	0.06	0.08	<0.01
p,p'-DDE	0.83	0.73	0.78	1.06
o,p'-DDE	-	-	-	<0.01
p,p'-DDD	1.6	1.4	1.5	1.16
o,p'-DDD	0.36	0.30	0.33	0.21
Total DDT	3.0	2.7	2.8	2.4
Dieldrin	0.001	0.014	0.008	<0.01
1242 PCB*	1.6	1.5	1.6	<0.01
1254 PCB*	1.1	1.1	1.1	0.50
Total PCB	2.7	2.6	2.6	0.50

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* SCCWRP values based on saponification

TABLE B-12

Concentrations (µg/l) of chlorinated hydrocarbons measured at SCCWRP, Bodega Marine Laboratory and County Sanitation Districts of Los Angeles County in 1-week composites of JWPCP simulated final effluent collected May 17-24, 1974.

Compound	SCCWRP			BML			CSDLAC
	R-1	R-2	Ave	R-1	R-2	Ave	R-1
p,p'-DDT	0.10	0.26	0.18	0.21	0.21	0.21	<0.01
o,p'-DDT	0.08	0.10	0.09	-	-	-	<0.01
p,p'-DDE	0.92	0.74	0.83	1.1	1.1	1.1	0.31
o,p'-DDE	-	-	-	-	-	-	<0.01
p,p'-DDD	1.7	1.5	1.6	1.1	1.0	1.0	1.02
o,p'-DDD	0.39	0.26	0.32	-	-	-	<0.13
Total DDT	3.2	2.9	3.0	2.4	2.3	2.4	1.3
Dieldrin	0.05	0.05	0.05	-	-	-	-
1242 PCB*	1.9	1.9	1.9	3.1	3.3	3.2	<0.01
1254 PCB*	1.3	1.3	1.3	0.68	0.68	0.68	0.58
Total PCB	3.2	3.2	3.2	3.8	4.0	3.9	0.58

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* SCCWRP and BML values based on saponification

TABLE B-13

Concentrations (µg/l) of chlorinated hydrocarbons measured at SCCWRP and County Sanitation Districts of Los Angeles County in 1-week composites of JWPCP simulated final effluent collected May 24-31, 1974.

	SCCWRP				CSDLAC
Compound	R-1	R-2	Ave	Blank	R-1
p,p'-DDT	0.41	0.47	0.44	<0.001	<0.01
o,p'-DDT	0.10	0.28	0.19	<0.001	<0.01
p,p'-DDE	0.86	1.1	0.98	<0.001	0.92
o,p'-DDE	-	-	-	-	<0.01
p,p'-DDD	1.8	2.8	2.3	<0.001	1.18
o,p'-DDD	0.28	0.42	0.35	-	0.21
Total DDT	3.4	5.1	4.2	<0.004	2.3
Dieldrin	0.024	0.086	0.055	<0.001	<0.01
1242 PCB*	2.0	2.1	2.0	0.005	<0.01
1254 PCB*	1.3	1.5	1.4	0.018	0.81
Total PCB	3.3	3.6	3.4	0.023	0.81

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* SCCWRP values determined by saponification

TABLE B-14

Concentrations (µg/l) of chlorinated hydrocarbons measured at SCCWRP and County Sanitation Districts of Los Angeles County in 1-week composites of JWPCP simulated final effluent collected May 31 - June 7, 1974.

Compound	SCCWRP				CSDLAC
	R-1	R-2	Ave	Blank	R-1
p,p'-DDT	0.33	0.43	0.38	<0.001	<0.01
o,p'-DDT	0.16	0.24	0.20	<0.001	<0.01
p,p'-DDE	0.87	0.86	0.86	<0.001	0.84
o,p'-DDE	-	-	-	-	<0.01
p,p'-DDD	1.3	1.5	1.4	<0.001	0.91
o,p'-DDD	0.23	0.17	0.20	-	0.18
Total DDT	2.9	3.2	3.0	<0.004	1.9
Dieldrin	0.008	<0.002	0.005	<0.001	-
1242 PCB*	2.2	2.0	2.1	0.005	<0.01
1254 PCB*	1.2	1.0	1.1	0.027	0.57
Total PCB	3.4	3.0	3.2	0.032	0.57

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* SCCWRP values determined by saponification

TABLE B-15

Concentrations (µg/l) of chlorinated hydrocarbons measured at SCCWRP and County Sanitation Districts of Los Angeles County in 1-week composites of JWPCP simulated final effluent collected June 7-14, 1974.

	SCCWRP				CSDLAC
Compound	R-1	R-2	Ave	Blank	R-1
p,p'-DDT	-	-	-	0.006	<0.01
o,p'-DDT	-	-	-	0.003	<0.01
p,p'-DDE	0.92	0.71	0.82	<0.001	0.80
o,p'-DDE	-	-	-	-	<0.01
p,p'-DDD	1.5	1.0	1.2	<0.001	1.16
o,p'-DDD	0.43	0.36	0.40	<0.001	0.54
Total DDT	2.8	2.1	2.4	0.009	2.5
Dieldrin	0.025	0.079	0.052	0.005	-
1242 PCB*	1.7	1.6	1.6	0.012	11.2
1254 PCB*	0.94	0.68	0.81	0.042	2.92
Total PCB	2.6	2.3	2.4	0.054	14.1

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* SCCWRP values based on saponification

TABLE B-16

Concentrations (µg/l) of chlorinated hydrocarbons measured by SCCWRP and CSDLAC in JWPCP simulated final effluent composites collected November 22-28, 1974.

	SCCWRP			CSDLAC*	
	Saponified			Unsaponified	Saponified**
Constituent	R-1	R-2	Ave.	Ave.	Ave.
p,p'-DDT	0.08	0.16	0.12	0.10	0.11
o,p'-DDT	0.02	0.04	0.03	<0.01	<0.01
p,p'-DDE	1.42	1.63	1.52	2.01	2.01
o,p'-DDE	0.44	0.49	0.46	<0.01	<0.01
p,p'-DDD	1.83	1.80	1.82	1.45	1.07
o,p'-DDD	0.44	0.41	0.42	0.68	0.36
Total DDT	4.23	4.53	4.38	4.26	3.57
1242 PCB	1.63	1.07	1.35	<0.01	1.49
1254 PCB	0.62	0.58	0.60	3.54	0.82
Total PCB	2.25	1.65	1.95	3.55	2.31

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* CSDLAC "regular" column: 5% QF-1, 4.7% OV-17, and 0.5% DC-200

** CSDLAC did not begin to routinely saponify JWPCP wastewater until January 1975

TABLE B-17

Concentrations of chlorinated hydrocarbons (µg/l) measured by SCCWRP in JWPCP final effluent collected February 21 - 27, 1975.

Constituent	Blank	R-1	R-2	Ave.
P,P'-DDT	<0.002	0.12	0.04	0.08
O,P'-DDT	<0.002	0.05	0.05	0.05
P,P'-DDE	<0.001	0.95	0.94	0.94
O,P'-DDE	<0.001	0.32	-	0.16
P,P'-DDD	<0.002	1.46	1.44	1.45
O,P'-DDD	<0.002	0.31	0.34	0.32
Total DDT	<0.010	3.21	2.81	3.00
1242 PCB	0.02	1.14	0.90	1.02
1254 PCB	<0.02	0.62	0.62	0.62
Total PCB	<0.04	1.76	1.52	1.64

TABLE B-18

Concentrations (µg/l) of chlorinated hydrocarbons measured by SCCWRP and CSDLAC in JWPCP final effluent composites collected July 18-23, 1975. PCB values after saponification.

Constituent	SCCWRP				CSDLAC			
	Blank*	R-1	R-2	Ave.	R-1	R-2	Ave.	Monitoring*
p,p'-DDT	0.005	0.10	0.08	0.09	0.07	0.08	0.08	0.14
o,p'-DDT	0.004	0.05	0.05	0.05	0.03	0.04	0.04	0.32
p,p'-DDE	0.002	0.90	0.82	0.86	0.77	0.68	0.72	0.86
o,p'-DDE	-	-	-	-	0.48	0.42	0.45	0.08
p,p'-DDD	0.005	1.3	1.1	1.2	0.77	0.77	0.77	0.84
o,p'-DDD	0.005	0.29	0.25	0.27	0.07	0.08	0.08	0.23
Total DDT	0.02	2.6	2.3	2.5	2.2	2.1	2.1	2.5
1242 PCB	0.048	0.68	0.62	0.65	0.50	0.66	0.58	2.16
1254 PCB	0.041	0.55	0.57	0.56	0.62	0.80	0.71	1.78
Total PCB	0.09	1.2	1.2	1.2	1.1	1.5	1.3	3.9

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* Regular monitoring data for JWPCP final effluent collected by CSDLAC over the same period

TABLE B-19

Concentrations of chlorinated hydrocarbons (μg/l) measured by SCCWRP in JWPCP final effluent collected December 12-18, 1975.

Constituent	Blank	R-1	R-2	Ave.
P,P'-DDT	0.014	0.25	0.11	0.18
O,P'-DDT	-	-	-	-
P,P'-DDE	0.002	1.11	1.05	1.08
O,P'-DDE	-	-	-	-
P,P'-DDD	< 0.001	1.41	1.28	1.34
O,P'-DDD	< 0.001	0.31	0.32	0.32
Total DDT	0.02	3.1	2.8	2.9
1242 PCB	0.26	1.26	1.31	1.28
1254 PCB	< 0.02	0.27	0.27	0.27
Total PCB	0.28	1.5	1.6	1.6

TABLE B-20

Concentrations (μg/l) of chlorinated hydrocarbons measured at SCCWRP and Hyperion Treatment Plant in 1-week composites of Hyperion 5-mile outfall effluent and 7-mile outfall sludge collected June 18-24, 1973.

	5-Mile Effluent				7-Mile Sludge			
	SCCWRP			Hyperion	SCCWRP			Hyperion
Compound	R-1	R-2	Ave	R-1	R-1	R-2	Ave	R-1
p,p'-DDT	0.06	0.06	0.06	0.08	-	-	-	0.33
o,p'-DDT	0.05	0.05	0.05	-	-	-	-	0.26
p,p'-DDE	0.02	0.01	0.02	0.50	1.6	1.6	1.6	0.15
o,p'-DDE	-	-	-	0.11	-	-	-	0.33
p,p'-DDD	-	-	-	-	1.2	0.9	1.1	0.52
o,p'-DDD	-	-	-	-	-	-	-	-
Total DDT	0.13	0.12	0.12	0.69	2.8	2.5	2.6	1.59
Dieldrin	0.04	0.13	0.08	0.03	5.98	5.74	5.86	0.60
1242 PCB	-	-	-	0.50	-	-	-	5.16
1254 PCB	0.38	0.34	0.36	-	31	32	32	-
Total PCB	0.38	0.34	0.36	0.50	31	32	32	5.16

TABLE B-21

Concentrations (µg/l) of chlorinated hydrocarbons measured at SCCWRP in 1-week composites of Hyperion Treatment Plant 5-mile outfall effluent and 7-mile sludge collected September 17-23, 1973.

	SCCWRP September 17-23, 1973						Hyperion* September 5-73	
	5-mile			7-mile			5-mile	7-mile
Compound	R-1	R-2	Ave	R-1	R-2	Ave	R-1	R-1
p,p'-DDT	0.06	0.04	0.05	-	-	-	0.09	0.55
o,p'-DDT	0.08	0.05	0.06	-	-	-	0.03	0.35
p,p'-DDE	-	-	-	0.31	-	0.16	0.92	-
o,p'-DDE	-	-	-	-	-	-	-	2.55
p,p'-DDD	-	0.003	0.002	-	-	-	0.15	0.88
o,p'-DDD	-	-	-	-	-	-	0.08	-
Total DDT	0.14	0.09	0.12	0.31	-	0.16	1.27	4.33
Dieldrin	0.07	0.06	0.06	2.4	2.8	2.6	-	0.63
1242 PCB	-	-	-	-	-	-	1.02	6.54
1254 PCB	0.47	0.34	0.40	20	20	20	-	-
Total PCB	0.47	0.34	0.40	20	20	20	1.02	6.54

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* Corresponding concentrations determined at Hyperion Treatment Plant in a 1-day composite collected September 5, 1973

TABLE B-22

Concentrations (μg/l) of chlorinated hydrocarbons measured at SCCWRP, Bodega Marine Laboratory, and Hyperion Treatment Plant in 1-week composites of Hyperion 5-mile outfall effluent collected June 5-11, 1974.

	SCCWRP			BML			Hyperion		
Compound	R-1	R-2	Ave	R-1	R-2	Ave	R-1	R-2	Ave
p,p'-DDT	0.07	0.08	0.08	0.081	0.040	0.060	-	-	-
o,p'-DDT	0.05	0.03	0.04	-	-	-	-	-	-
p,p'-DDE	0.01	0.01	0.01	0.010	0.006	0.008	-	-	-
o,p'-DDE	-	-	-	-	-	-	-	-	-
p,p'-DDD	0.14	0.09	0.12	-	-	-	<0.01	0.01	0.01
o,p'-DDD	-	-	-	-	-	-	-	-	-
Total DDT	0.27	0.21	0.24	0.091	0.046	0.068	<0.01	0.01	0.01
Dieldrin	0.05	<0.01	0.03	-	-	-	<0.01	-	<0.01
1242 PCB*	-	-	-	-	-	-	-	-	-
1254 PCB*	0.47	0.40	0.44	0.20	0.17	0.18	-	-	-
Total PCB	0.47	0.40	0.44	0.20	0.17	0.18	-	-	-

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* SCCWRP and BML values based on saponification

TABLE B-23

Concentrations (μg/l) of chlorinated hydrocarbons measured at SCCWRP, Bodega Marine Laboratory, and Hyperion Treatment Plant in 1-week composites of Hyperion 7-mile outfall sludge collected June 5-11, 1974.

	SCCWRP			BML			Hyperion		
Compound	R-1	R-2	Ave	R-1	R-2	Ave	R-1	R-2	Ave
p,p'-DDT	0.14	0.43	0.28	-	-	-	0.02	0.01	0.02
o,p'-DDT	0.57	0.37	0.47	-	-	-	-	0.02	0.01
p,p'-DDE	-	-	-	1.1	1.4	1.2	-	-	-
o,p'-DDE	-	-	-	-	-	-	-	-	-
p,p'-DDD	-	-	-	-	-	-	0.04	0.04	0.04
o,p'-DDD	-	-	-	-	-	-	-	-	-
Total DDT	0.71	0.80	0.76	1.1	1.4	1.2	0.06	0.07	0.06
Dieldrin	0.24	0.10	0.17	-	-	-	0.06	0.06	0.06
1242 PCB*	27	24	26	46	52	49	0.05	0.05	0.05
1254 PCB*	11	14	12	16	15	16	-	-	-
Total PCB	38	38	38	62	67	64	0.05	0.05	0.05

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[*] SCCWRP and BML values based on saponification

TABLE B-24

Concentrations of chlorinated hydrocarbons (µg/1) measured by SCCWRP in 5-day composites of Hyperion Treatment Plant 7-mile outfall sludge collected June 13-18, 1974.

Compound	Blank	R-1	R-2	Ave.
p,p'-DDT	<0.005	0.36	0.86	0.61
o,p'-DDT	<0.004	0.32	0.92	0.62
p,p'-DDE	<0.002	-	-	-
o,p'-DDE	-	-	-	-
p,p'-DDD	<0.005	-	-	-
o,p'-DDD	<0.005	-	-	-
Total DDT	<0.021	0.68	1.8	1.2
Dieldrin	0.021	0.21	0.25	0.23
1242*PCB	<0.009	36.9	28.5	32.7
1254*PCB	<0.030	28.3	21.6	25.0
Total PCB	<0.039	65.2	50.1	57.6

* PCB values based on saponification

TABLE B-25

Concentrations of chlorinated hydrocarbons (μg/l) measured by SCCWRP in 5-day composites of Hyperion Treatment Plant 7-mile outfall sludge collected June 19-24, 1974.

Compound	Blank	R-1	R-2	Ave.
p,p'-DDT	<0.005	0.89	0.45	0.67
o,p'-DDT	<0.004	0.86	0.55	0.70
p,p'-DDE	<0.002	-	-	-
o,p'-DDE	-	-	-	-
p,p'-DDD	<0.005	-	-	-
o,p'-DDD	<0.005	-	-	-
Total DDT	<0.021	1.8	1.0	1.4
Dieldrin	0.019	0.44	0.12	0.28
1242 PCB*	<0.009	31.8	29.8	30.8
1254 PCB*	<0.030	21.3	20.4	20.8
Total PCB	<0.039	53.1	50.2	51.6

* PCB values based on saponification

TABLE B-26

Concentrations (µg/l) of chlorinated hydrocarbons measured by SCCWRP and Hyperion Treatment Plant in Hyperion 5-mile effluent collected December 3-9, 1974.

	SCCWRP			Hyperion		
Constituent	R-1	R-2	Ave.	R-1	R-2	Ave.
p,p'-DDT	0.032	0.026	0.029	0.03	0.02	0.02
o,p'-DDT	0.011	0.011	0.011	-	0.01	0.01
p,p'-DDE	0.013	0.013	0.013	-	-	-
o,p'-DDE	-	-	-	0.07	0.07	0.07
p,p'-DDD	0.024	0.027	0.026	0.02	0.01	0.02
o,p'-DDD	-	-	-	-	-	-
Total DDT	0.080	0.077	0.079	0.12	0.11	0.12
1242 PCB	0.11	0.11	0.11	0.13	0.17	0.15
1254 PCB	0.19	0.17	0.18	-	-	-
Total PCB	0.30	0.28	0.29	0.13	0.17	0.15

TABLE B-27

Concentrations (µg/l) of chlorinated hydrocarbons measured by SCCWRP and Hyperion Treatment Plant in 7-mile outfall sludge collected December 3-9, 1974.

	SCCWRP			Hyperion		
Constituent	R-1	R-2	Ave.	R-1	R-2	Ave.
p,p'-DDT	1.21	0.45	0.83	0.62	0.83	0.72
o,p'-DDT	0.65	-	0.32	0.31	0.62	0.46
p,p'-DDE	3.08	2.86	2.97	1.19	2.90	2.04
o,p'-DDE	-	-	-	2.67	3.08	2.88
p,p'-DDD	-	-	-	0.57	0.96	0.76
o,p'-DDD	-	-	-	0.82	0.99	0.90
Total DDT	4.94	3.31	4.12	6.18	9.38	7.76
1242 PCB	90	118	104	8.9	10.1	9.5
1254 PCB	74	92	83	-	-	-
Total PCB	164	210	187	8.9	10.1	9.5

TABLE B-28a

PCB concentrations (µg/l) in split replicate samples of 7-mile outfall sludge collected December 3-9, 1974 and analyzed by routine procedures at the SCCWRP and Hyperion laboratories.

	SCCWRP			Hyperion		
	R-1	R-2	Ave.	R-1	R-2	Ave.
1242 PCB	90	118	104	8.9	10.1	9.5
1254 PCB	74	92	83	-	-	-
Total PCB	164	210	187	8.9	10.1	9.5

TABLE B-28b

PCB concentrations (µg/l) in replicate samples of 7-mile outfall sludge collected December 3-9, 1974, which were extracted at Hyperion, saponified at SCCWRP, and analyzed at each laboratory.

	SCCWRP			Hyperion		
ID:	#1045	#1046	Ave.	#1045	#1046	Ave.
1242 PCB	27	27	27	14	6.7	10
1254 PCB	12	15	14	24	42	33
Total PCB	39	42	41	38	48	43

TABLE B-29

Concentrations of chlorinated hydrocarbons (µg/l) measured by SCCWRP in Hyperion 5-mile effluent collected June 27 - July 3, 1975.

Constituent	Blank	R-1	R-2	Ave.
p,p'-DDT	0.004	0.038	0.032	0.035
o,p'-DDT	<0.001	0.006	0.004	0.005
p,p'-DDE	<0.001	0.014	0.013	0.014
o,p'-DDE	-	-	-	-
p,p'-DDD	<0.001	0.017	0.020	0.018
o,p'-DDD	-	-	-	-
Total DDT	<0.007	0.075	0.069	0.072
1242 PCB	0.069	0.10	0.14	0.12
1254 PCB	0.029	0.22	0.19	0.20
Total PCB	0.01	0.32	0.33	0.32

TABLE B-30

Concentrations of chlorinated hydrocarbons ($\mu g/l$) measured by SCCWRP in Hyperion 7-mile outfall sludge collected June 27 - July 6, 1975.

Constituent	Blank	R-1	R-2	Ave.
p,p'-DDT	-	-	-	-
o,p'-DDT	-	-	-	-
p,p'-DDE	<0.02	1.04	0.78	0.91
o,p'-DDE	-	-	-	-
p,p'-DDD	<0.05	1.89	1.89	1.89
o,p'-DDD	<0.04	0.31	0.18	0.24
Total DDT	<0.1	3.2	2.8	3.0
1242 PCB	<0.08	34	35	34
1254 PCB	<0.31	26	31	28
Total PCB	<0.4	60	66	62

TABLE B-31

Concentrations of chlorinated hydrocarbons (µg/l) measured by SCCWRP in Hyperion 5-mile effluent collected December 15-21, 1975.

Constituent	Blank	R-1	R-2	Ave.
p,p'-DDT	0.004	0.023	0.039	0.031
o,p'-DDT	0.002	0.003	0.007	0.005
p,p'-DDE	0.004	0.008	0.014	0.011
o,p'-DDE	-	-	-	-
p,p'-DDD	<0.001	0.013	0.020	0.016
o,p'-DDD	-	-	-	-
Total DDT	<0.011	0.047	0.080	0.063
1242 PCB	0.018	0.18	0.24	0.21
1254 PCB	0.024	0.14	0.19	0.16
Total PCB	0.042	0.32	0.43	0.37

TABLE B-32

Concentrations of chlorinated hydrocarbons (μg/l) measured by SCCWRP in Hyperion 7-mile outfall sludge collected December 15-21, 1975.

Constituent	Blank	R-1	R-2	Ave.
p,p'-DDT	-	-	-	-
o,p'-DDT	-	-	-	-
p,p'-DDE	0.28	0.88	0.88	0.88
o,p'-DDE	-	-	-	-
p,p'-DDD	<0.06	1.76	1.88	1.82
o,p'-DDD	<0.06	0.23	0.45	0.34
Total DDT	<0.40	2.87	3.21	3.04
1242 PCB	0.66	6.0	6.3	6.2
1254 PCB	<0.36	11	12	12
Total PCB	<1.02	17	18	18

TABLE B-33

Concentrations (µg/l) of chlorinated hydrocarbons by SCCWRP and Orange County Sanitation Districts in 1-week composites of OCSD final effluent collected July 5-11, 1973 and September 8-14, 1973.

Compound	July 5-11, 1973						September 8-14, 1973					
	SCCWRP			OCSD			SCCWRP			OCSD		
	R-1	R-2	Ave	R-1	R-2	Ave	R-1	R-2	Ave	R-1	R-2	Ave
p,p'-DDT	-	-	-	-	-	-	-	-	-	-	-	-
o,p'-DDT	-	-	-	-	-	-	-	-	-	-	-	-
p,p'-DDE	0.04	0.08	0.06	-	-	-	-	-	-	-	-	-
o,p'-DDE	-	-	-	-	-	-	-	-	-	-	-	-
p,p'-DDD	0.01	0.04	0.02	-	-	-	0.02	-	0.01	-	-	-
o,p'-DDD	-	-	-	-	-	-	-	-	-	-	-	-
Total DDT	0.05	0.12	0.08	-	-	-	0.02	-	0.01	-	-	-
Dieldrin	0.15	0.29	0.22	0.77	3.20	1.98	0.05	0.05	0.05	0.06	0.11	0.08
1242 PCB	-	-	-	3.66	3.78	3.72	-	-	-	-	-	-
1254 PCB	1.8	1.9	1.8	-	-	-	1.0	1.1	1.0	6.91	5.44	6.18
Total PCB	1.8	1.9	1.8	3.66	3.78	3.72	1.0	1.1	1.0	6.91	5.44	6.18

TABLE B-34

Concentrations (µg/1) of chlorinated hydrocarbons measured by SCCWRP, Bodega Marine Laboratory, and Orange County Sanitation District in 1-week composites of OCSD final effluent collected May 18-24, 1974.

Compound	SCCWRP			BML			OCSD		
	R-1	R-2	Ave	R-1	R-2	Ave	R-1	R-2	Ave
p,p'-DDT	0.11	-	0.06	0.040	0.048	0.044	-	-	-
o,p'-DDT	0.03	-	0.02	-	-	-	-	-	-
p,p'-DDE	-	-	-	0.026	0.022	0.024	0.01*	0.12*	0.06*
o,p'-DDE	-	-	-	-	-	-	-	-	-
p,p'-DDD	0.30	0.67	0.48	0.030	0.027	0.028	-	-	-
o,p'-DDD	-	-	-	-	-	-	-	-	-
Total DDT	0.44	0.67	0.56	0.096	0.097	0.096	0.01	0.12	0.06
Dieldrin	0.21	0.29	0.25	-	-	-	0.08	0.05	0.06
1242 PCB**	10.3	10.8	10.6	11.0	13.0	12.0	7.0^+	12.1^+	9.6^+
1254 PCB**	1.4	1.5	1.4	0.80	0.80	0.80	-	-	-
Total PCB	11.7	12.3	12.0	11.8	13.8	12.8	7.0	12.1	9.6

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* Sum of p,p'-DDE + o,p'-DDD

** SCCWRP and BML values based on saponification

+ Quantitated as 1248 PCB

TABLE B-35

Concentrations (µg/l) of chlorinated hydrocarbons measured by SCCWRP and Orange County Sanitation District in OCSD final effluent collected November 4-10, 1974.

	SCCWRP					OCSD		
Constituent	R-1	R-2	R-3	R-4	Ave.	R-1	R-2	Ave.
p,p'-DDT	0.017	0.012	-	-	0.007	-	0.06	0.03
o,p'-DDT	0.003	0.004	-	-	0.002	-	-	-
p,p'-DDE	0.005	0.010	0.012	0.016	0.011	-	-	-
o,p'-DDE	-	-	-	-	-	-	0.03	0.02
p,p'-DDD	-	-	-	-	-	-	-	-
o,p'-DDD	-	-	-	-	-	-	-	-
Total DDT	0.025	0.026	0.012	0.016	0.020	-	0.09	0.05
1242 PCB	5.3	4.9	4.7	4.8	4.9	8.3	8.8	8.6
1254 PCB	0.57	0.59	0.65	0.70	0.63	1.6	1.6	1.6
Total PCB	5.9	5.5	5.4	5.5	5.5	9.9	10.4	10.2

TABLE B-36a

Comparison of chlorinated hydrocarbon concentrations (µg/l) measured by SCCWRP, OCSD, and CSDLAC in OCSD final effluent collected July 7-14, 1975. (SCCWRP and CSDLAC PCB values based on saponified samples).

Constituent	SCCWRP*			OCSD**			CSDLAC+		
	R-1	R-2	Ave.	R-1	R-2.	Ave.	R-1	R-2	Ave.
p,p'-DDT	-	-	-	-	-	-	0.12	0.11	0.12
o,p'-DDT	-	-	-	-	-	-	0.13	0.15	0.14
p,p'-DDE	0.03	0.02	0.02	-	-	-	0.12	0.08	0.10
p,p'-DDD	0.02	0.03	0.03	-	-	-	0.09	0.10	0.10
Total DDT	0.05	0.05	0.05	-	-	-	0.46	0.44	0.45
1242 PCB	5.35	5.05	5.20	12.0	11.5	11.8	4.90	4.62	4.76
1254 PCB	0.62	0.64	0.63	0.37	0.45	0.40	0.33	0.33	0.33
Total PCB	6.0	5.7	5.8	12.4	12.0	12.2	5.2	5.0	5.1

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* Corrected for 1242 and 1254 blanks of 0.04 and 0.04 ppb

** Corrected for 1242 and 1254 blanks of 0.78 and 1.09 ppb

+ Corrected for 1242 and 1254 blanks of 0.01 and 0.01 ppb

TABLE B-36b

PCB concentrations (µg/l) measured when the original extracts from SCCWRP and OCSD were exchanged and re-analyzed.

	OCSD Extraction SCCWRP Analysis*			SCCWRP Extraction OCSD Analysis		
	R-1	R-2	Ave.	R-1	R-2	Ave.
1242 PCB	3.9	5.8	4.8	5.4	5.2	5.3
1254 PCB	1.6	2.3	2.0	-	-	-
Total PCB	5.5	8.1	6.8	5.4	5.2	5.3

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* Corrected for 1242 and 1254 (extraction) blanks of 1.2 and 1.0 ppb

TABLE B-37a

Comparison of chlorinated hydrocarbon concentrations (µg/l) measured by SCCWRP and OCSD in OCSD final effluent collected December 12-18, 1975. (all PCB values based on saponification).

Constituent	SCCWRP			OCSD*		
	R-1	R-2	Ave.	R-1	R-2	Ave.
p,p'-DDT	-	-	-	0.03	0.04	0.04
p,p'-DDE	0.01	0.04	0.02	-	-	-
Total DDT	0.01	0.04	0.02	0.03	0.04	0.04
1242 PCB	7.6	7.9	7.8	5.8	5.4	5.6
1254 PCB	0.93	0.97	0.95	0.95	0.96	0.96
Total PCB	8.7	8.9	8.8	6.8	6.4	6.6

* PCB values Blank-corrected; SCCWRP Blanks negligible

TABLE B-37b

PCB concentrations (µg/l) measured by SCCWRP in OCSD extracts of final effluent composites collected December 12-18, 1975.

Constituent*	R-1	R-2	Ave.
1242 PCB	4.9	5.3	5.1
1254 PCB	1.9	1.3	1.6
Total PCB	6.8	6.6	6.7

* Corrected for 1242 and 1254 PCB Blanks of 0.5 and 1.2 ppb

TABLE B-38

Concentrations (μg/l) of chlorinated hydrocarbons measured at SCCWRP in 1-week composites of Point Loma Treatment Plant final effluent collected June 28- July 4, 1973 and September 14-20, 1973.

Compound	June 28 - July 4			September 14-20		
	R-1	R-2	Ave	R-1	R-2	Ave
p,p'-DDT	0.026	0.017	0.022	0.011	0.014	0.012
o,p'-DDT	-	-	-	-	-	-
p,p'-DDE	0.034	0.055	0.044	0.042	0.050	0.046
o,p'-DDE	-	-	-	-	-	-
p,p'-DDD	0.10	0.18	0.14	0.12	0.094	0.11
o,p'-DDD	-	-	-	-	-	-
Total DDT	0.16	0.25	0.20	0.17	0.16	0.16
Dieldrin	0.081	0.11	0.096	0.088	0.077	0.082
1242 PCB	-	-	-	-	-	-
1254 PCB	0.44	0.66	0.55	0.44	0.40	0.42
Total PCB	0.44	0.66	0.55	0.44	0.40	0.42

TABLE B-39

Concentrations (μg/l) of chlorinated hydrocarbons measured at SCCWRP, Bodega Marine Laboratory, and Point Loma Treatment Plant in 1-week composites of PLTP final effluent collected May 18-24, 1974.

Compound	SCCWRP			BML			PLTP
	R-1	R-2	Ave	R-1	R-2	Ave	R-1
p,p'-DDT	0.05	0.05	0.05	0.14	0.15	0.14	-
o,p'-DDT	0.06	0.03	0.04	-	-	-	-
p,p'-DDE	-	-	-	0.021	0.017	0.019	5.3
o,p'-DDE	-	-	-	-	-	-	-
p,p'-DDD	0.07	0.05	0.06	0.030	0.032	0.031	-
o,p'-DDD	-	-	-	-	-	-	-
Total DDT	0.18	0.13	0.16	0.19	0.20	0.20	5.3
Dieldrin	0.02	0.002	0.01	-	-	-	-
1242 PCB*	9.1	8.8	9.0	11.0**	8.9**	10.0**	-
1254 PCB*	0.82	0.58	0.70	0.39	0.37	0.38	-
Total PCB	9.9	9.4	9.6	11.4	9.3	10.4	-

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* SCCWRP and BML values based on saponification

** Identified as 1016 PCB

TABLE B-40

Concentrations of chlorinated hydrocarbons (µg/l) measured by SCCWRP in Point Loma Treatment Plant final effluent collected November 4 - 10, 1974.

Constituent	Blank	R-1	R-2	Ave.
p,p'-DDT	-	-	-	-
o,p'-DDT	-	-	-	-
p,p'-DDE	0.017	0.022	0.030	0.026
o,p'-DDE	-	-	-	-
p,p'-DDD	-	-	-	-
o,p'-DDD	-	-	-	-
Total DDT	0.017	0.022	0.030	0.026
1242 PCB	0.028	3.77	3.86	3.82
1254 PCB	<0.013	1.01	0.88	0.94
Total PCB	<0.041	4.78	4.74	4.76

TABLE B-41

Concentrations of chlorinated hydrocarbons (µg/l) measured by SCCWRP in Point Loma Treatment Plant final effluent collected July 21 - 28, 1975.

Constituent	Blank	R-1	R-2	Ave.
p,p'-DDT	-	-	-	-
o,p'-DDT	-	-	-	-
p,p'-DDE	<0.001	0.013	0.012	0.012
o,p'-DDE	-	-	-	-
p,p'-DDD	<0.001	0.037	0.034	0.036
o,p'-DDD	<0.001	0.014	0.006	0.010
Total DDT	<0.003	0.064	0.052	0.058
1242 PCB	0.04	1.09	1.24	1.16
1254 PCB	0.05	0.45	0.43	0.44
Total PCB	0.09	1.5	1.7	1.6

TABLE B-42

Concentrations of chlorinated hydrocarbons ($\mu g/l$) measured by SCCWRP in Point Loma Treatment Plant final effluent collected December 14-21, 1975.

Constituent	Blank	R-1	R-2	Ave.
p,p'-DDT	-	-	-	-
o,p'-DDT	-	-	-	-
p,p'-DDE	<0.001	0.018	0.014	0.016
o,p'-DDE	-	-	-	-
p,p'-DDD	<0.001	0.053	0.057	0.055
o,p'-DDD	<0.001	0.053	0.044	0.048
Total DDT	<0.003	0.12	0.12	0.12
1242 PCB	0.05	1.17	0.93	1.05
1254 PCB	0.03	0.63	0.60	0.62
Total PCB	0.08	1.80	1.53	1.67

TABLE B-43

Concentrations (µg/l) of chlorinated hydrocarbons measured at SCCWRP in 1-week composites of Oxnard Treatment Plant final effluent collected September 17-21, 1973.

Compound	R-1	R-2	Ave
p,p'-DDT	0.17	0.17	0.17
o,p'-DDT	0.17	0.13	0.15
p,p'-DDE	0.13	0.11	0.12
o,p'-DDE	0.006	-	0.003
p,p'-DDD	0.022	0.059	0.040
o,p'-DDD	-	-	-
Total DDT	0.50	0.47	0.48
Dieldrin	0.015	0.014	0.014
1242 PCB	-	-	-
1254 PCB	0.32	0.38	0.35
Total PCB	0.32	0.38	0.35

TABLE B-44

Concentrations (µg/l) of chlorinated hydrocarbons measured at SCCWRP and Bodega Marine Laboratory in 1-week composites of Oxnard Treatment Plant final effluent collected May 6-10 1974*.

Compound	SCCWRP			BML		
	R-1	R-2	Ave	R-1	R-2	Ave
p,p'-DDT	0.07	0.07	0.07	0.17	0.13	0.15
o,p'-DDT	-	0.08	0.04	-	-	-
p,p'-DDE	-	-	-	0.032	0.028	0.030
o,p'-DDE	-	-	-	-	-	-
p,p'-DDD	0.36	0.06	0.21	-	-	-
o,p'-DDD	-	-	-	-	-	-
Total DDT	0.43	0.21	0.32	0.20	0.16	0.18
Dieldrin	0.004	0.003	0.004	-	-	-
1242 PCB**	0.15	0.36	0.26	-	-	-
1254 PCB**	0.49	0.30	0.40	0.14	0.11	0.12
Total PCB	0.49- 0.64	0.30- 0.66	0.40- 0.65	0.14	0.11	0.12

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* SCCWRP analyses suggest possible contamination

** SCCWRP and BML values based on saponification

TABLE B-45

Concentrations of chlorinated hydrocarbons (μg/l) measured by SCCWRP in Oxnard Treatment Plant effluent collected November 18 - 22, 1974.

Constituent	Blank	R-1	R-2*	Ave.
p,p'-DDT	< 0.002	0.038		0.038
o,p'-DDT	<0.001	-		-
p,p'-DDE	<0.001	0.156		0.156
o,p'-DDE	<0.001	-		-
p,p'-DDD	<0.002	0.091		0.091
o,p'-DDD	<0.002	0.023		0.023
Total DDT	0.09	0.308		0.308
1242 PCB	0.008	0.081		0.081
1254 PCB	< 0.013	0.304		0.304
Total PCB	<0.021	0.385		0.385

* No data; chromatogram questionable

TABLE B-46

Concentrations of chlorinated hydrocarbons (µg/l) measured by SCCWRP in Oxnard Treatment Plant effluent collected June 30 - July 4, 1975.

Constituent	Blank	R-1	R-2	Ave.
p,p'-DDT	0.001	0.009	0.016	0.012
o,p'-DDT	-	-	-	-
p,p'-DDE	< 0.001	0.028	0.035	0.032
o,p'-DDE	-	-	-	-
p,p'-DDD	-	-	-	-
o,p'-DDD	-	-	-	-
Total DDT	< 0.002	0.037	0.051	0.044
1242 PCB	0.030	0.026	0.085	0.056
1254 PCB	0.017	0.168	0.187	0.178
Total PCB	0.05	0.19	0.27	0.23

TABLE B-47

Concentrations of chlorinated hydrocarbons (μg/l) measured by SCCWRP in Oxnard Treatment Plant effluent collected December 3 - 7, 1975.

Constituent	Blank	R-1	R-2	Ave.
p,p'-DDT	<0.001	0.008	-	0.004
o,p'-DDT	-	-	-	-
p,p'-DDE	0.002	0.102	0.083	0.0925
o,p'-DDE	-	-	-	-
p,p'-DDD	0.004	0.055	0.035	0.045
o,p'-DDD	<0.001	0.006	0.004	0.005
Total DDT	<0.008	0.171	0.122	0.146
1242 PCB	0.063	0.138	0.050	0.094
1254 PCB	0.070	0.216	0.251	0.234
Total PCB	0.133	0.354	0.301	0.328

TABLE B-48

Concentrations (µg/l) of chlorinated hydrocarbons measured at SCCWRP in 1-week composites of Terminal Island Plant final effluent collected February 19-25, 1974*.

Compound	R-1	R-2	Ave
p,p'-DDT	0.14	0.064	0.10
o,p'-DDT	0.029	0.014	0.022
p,p'-DDE	0.027	0.027	0.027
o,p'-DDE	-	-	-
p,p'-DDD	0.15	0.086	0.12
o,p'-DDD	-	-	-
Total DDT	0.35	0.19	0.27
Dieldrin	0.047	0.025	0.036
1242 PCB	-	-	-
1254 PCB	0.21	0.09	0.15
Total PCB	0.21	0.09	0.15

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* Approximate discharge rate into San Pedro Harbor: 10 mgd

TABLE B-49

Summary of equivalent chlorinated hydrocarbon concentrations ($\mu g/l$) found in sixteen process blanks measured during SCCWRP analyses of municipal wastewaters, May 1973 - June 1974.

Compounds	Average	Median	Range
p,p'-DDT	0.004	0.003	0.001- 0.016
o,p'-DDT	0.003	0.001	0.001- 0.013
p,p'-DDE	0.001	0.001	ND* - 0.003
o,p'-DDE	0.001	ND	ND - 0.002
p,p'-DDD	0.002	0.001	ND - 0.005
o,p'-DDD	0.001	ND	ND - 0.005
Total DDT	0.011	0.011	0.004- 0.021
Dieldrin	0.005	0.001	ND - 0.021
Non-saponified blanks (n=5)			
PCB 1242	0.096	0.008	0.002- 0.259
PCB 1254	0.035	0.021	0.006- 0.093
Total PCB	0.131	0.029	0.008- 0.297
Saponified blanks (n=11)			
PCB 1242	0.008	0.009	0.005- 0.012
PCB 1254	0.033	0.030	0.018- 0.049
Total PCB	0.041	0.039	0.023- 0.063

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* Not detected

APPENDIX C

DIRECT INDUSTRIAL DISCHARGES

Table C-1 presents concentrations of chlorinated hydrocarbons measured during 1973 in individual 4-hour composites of industrial effluents discharged directly into the San Pedro Harbor. Corresponding results for San Diego Harbor and the nearby coast are listed in Table C-2.

TABLE C-1

Chlorinated hydrocarbons in industrial wastes discharged in marine waters of San Pedro Harbor.

				µg/l			
Source	Type	SCCWRP Sample #	Average Flow (mgd)	Total DDT	Dieldrin	1242 PCB	1254 PCB
Los Angeles Harbor - 1973							
Chemical	Comb. Proc.	281	5.51	0.002	0.002	0.006	0.026
Cannery	Waste	280	5.55	0.490	0.016	68	0-0.054
Cannery	Condenser H_2O	292	1.94	-*	0-0.063	-*	-*
Cannery	Waste	282	3.20	0.096	0-0.002	22	0-0.174
Cannery	Retort Discharge	290	0.120	0.007-0.008	0.001	0.024	0.017
Oil Indust.	Cooling	289	0.020	0.002	0.001	0.016	0.018
Power	Cooling	286	257	0.002	0.001	0.017	0-0.006
Shipyard	Cooling	287	0.040	0.003	0.012	0.042	0.654
Shipyard	Cooling	285	0.430	0.001	0.001	0.015	0.013
Shipyard	Oil Tanker Cleandown	291	0.250	0.180	-*	3.74	2.10
Shipyard	Ship ballast	279	0.040	-*	0.010	77	0-1.52
Shipyard	Ship ballast	283	0.29	-*	0.024	0-0.007	0-0.022
Blank				<0.001	0.002	<0.001	<0.003
Long Beach Harbor - 1973							
Chemical	Cooling	298	0.047	0.019	0.001	0.049	0.017
Chemical	Cooling	299	0.040	0.127	0-0.003	0-0.005	0.008
Chemical	Cooling	300	0.529	0.004	0.003	0.037	0-0.004
Chemical	Yard Runoff	301	0.004	0.094	0.002	2.12	0.182
Oil Indust.	Cooling	296	0.047	0.012	0-0.001	0.340	0-0.008
Oil Indust.	Cooling	302	0.200	0.116	0-0.001	0-0.002	0.027
Oil Indust.	Cooling	303	0.319	0.013	0.002	0.034	0.026
Oil Indust.	Cooling	304	0.270	0.100	0.074	0.035	0.035
Misc.	Auto Wash	297	0.040	0.003	0.052	0-0.002	0-0.009
Misc.	Cooling	305	0.125	0.130	0.026	0.139	0.157
Blank				<0.004	0.002	0.036	<0.004

* No data; questionable chromatogram

TABLE C-2

Chlorinated hydrocarbons in industrial wastes discharged in marine waters off San Diego, 1974.

Source	Type	SCCWRP Sample #	Average Flow (mgd)	µg/1 Total DDT	µg/1 1242 PCB	µg/1 1254 PCB
Inside San Diego Harbor						
Chemical	Cooling	369	0.200	0-0.004	0-0.002	0.007
Chemical	Brine	361	0.036	0.204	0-0.008	0-0.007
Chemical	Brine	364	0.012	-	0-0.003	0.764*
Chemical	Brine	365	0.060	0-0.004	0-0.005	0.099
Cannery	Flume Brine	370	2.75	0-0.004	0-0.018	0.012
Power	Cooling	368	100	0.003-0.006	0-0.002	0.008
Power	Cooling	371	215	0-0.004	0-0.090	0.018
Power	Cooling	363	434	0-0.006	0-0.003	0-0.006
Misc.	Cooling	366	6.05	0-0.004	0-0.002	0.008
Misc.	Cooling	367	1.29	0-0.004	0-0.002	0.012
Misc.	Cooling	362	0.360	0-0.006	0-0.008	0-0.006
North San Diego County Coast						
Aquarium	Filter Brine	372	0.003	0.014-0.016	0-0.018	0.054
Aquarium	Aquarium Discharge	373	0.863	0-0.004	0-0.025	0.012
Aquarium	Aquarium Discharge	374	0.288	0-0.004	0-0.022	0.018
Power	Cooling		199	0-0.004	0-0.037	0.041
Blank				<0.006	<0.008	<0.006

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[*] 1260 PCB also detected: 0.648 µg/1

APPENDIX D

VESSEL ANTIFOULING PAINTS

Table D-1 lists concentrations of 1242 and 1254 PCB measured in individual samples of those vessel antifouling paints used in greatest quantities in southern California harbors and marinas during 1973.

TABLE D-1

Polychlorinated biphenyl concentrations in antifouling paints used in southern California, 1973.

Sample No.	Brand and Type	PCB (mg/L)	
		1242	1254
RECREATIONAL			
	Brolite Z-Spar		
P23	2000	<0.06	<0.16
P48	Multitox	<0.05	1.6
P34	Colortox	-	0.29
P53	Killer (B-90)	<0.3	<0.6
P37	A-1316 (1969)	<0.4	<1.2
	Woolsey		
P24	Vinelast (Blue)	<0.3	<1.0
P39	Vinelast (Red)	<0.1	<0.3
	International		
P28	Inter-lux 62	<0.2	<0.6
P26	Bottomkote 69	<0.4	<1.1
P20	Vinyl-lux	<0.03	<0.07
P19	Tri-lux	<0.3	<1.0
P18	Copper-lux	<0.06	<0.15
	Pettit		
P25	Unepoxy	<0.01	<0.03
P51	Trinidad 75 (red)	<0.09	<0.2
P31	Pacific Special	1.7	1.2
	Mariner's		
P2	1034 Lido	<0.3	<0.6
	Singapore		
P32	696 Blue	<0.4	<1.2
	Devoe-Reynolds		
P30	Navicote	<84	<220
P63	Triple C	12.0	28.0
COMMERCIAL			
	Devoe-Reynolds		
P54	Super Tropical	18	23
P58	3407	<0.005	<0.023
P59	213	<0.92	<0.29
P64	Hot Plastic	1.30	3.00
P55	Cold Plastic 105	<1.6	<4.0
	Amarcoat		
P62	Emeron 67	1.20	2.80
	Proline		
P57	1080	<0.17	<0.72
NAVY			
	Devoe-Reynolds		
P60	121/63	<0.1	<0.4
P61	129/63	<0.1	<0.4

APPENDIX E

HARBOR FLUSHING

Table E-1 presents estimated tidal flow rates through the mouths of San Pedro, Newport and San Diego Harbors sampled over semidiurnal tidal cycles in fall, 1974; corresponding concentrations of total DDT and 1254 PCB are also shown. This portion of the research was conducted under a contract with the University of California at San Diego in connection with the Marine Research Committee, Department of Fish and Game (State of California Agreement M-11).

TABLE E-1

Concentrations (ng/l) of chlorinated hydrocarbon measured in surface seawater collected at the mouths of three major southern California harbors over semi-diurnal tidal cycles. Each value based on two replicate samples.

SAN PEDRO HARBOR* (Nov. 16, 1974)			
PST Time	Flow ** (10^3l/sec)	Total DDT (ng/l)	1254 PCB (ng/l)
0800		0.21	0.63
0830	+ 464		
0930	+ 114		
1030	+ 1,422		
1130	+ 2,167		
1200		7.0	0.09
1230	+ 2,008		
1330	+ 1,897		
1430	+ 1,611		
1500		5.9	2.7
1530	+ 1,178		
1630	+ 606		
1730	+ 42		
1800		12	2.4
1830	- 225		
1930	- 711		
2100		8.0	4.6

NEWPORT HARBOR (Dec. 10, 1974)			
PST Time	Flow (10^3l/sec)	Total DDT (ng/l)	1254 PCB (ng/l)
0700	+ 44	0.53	15
0800	+ 375		
0900	+ 425		
1000	+ 567	9.3	16
1100	+ 533		
1200	+ 366		
1300	+ 50	18	17
1400	- 14		
1500	- 64		
1600	- 28	7.6	14
1700	- 94		
1800	- 44		
1900	- 139	0.82	107

SAN DIEGO HARBOR (Nov. 11, 1974)			
PST Time	Flow (10^3l/sec)	Total DDT (ng/l)	1254 PCB (ng/l)
0700		1.2	0.86
0730	+ 842		
0830	+ 4,986		
0930	+ 5,730		
1000		0.28	1.42
1030	+ 6,083		
1130	+ 5,000		
1230	+ 2,906		3.0
1300		0.39	2,98
1330	+ 1,536		
1430	- 1,361		
1530	- 3,114		2.6
1600	-	0.31	2.56
1630	- 3,800		
1730	- 3,879		
1830	- 1,856		1.1
1900		0.48	1.06

* Western Entrace only

** Positive values indicate outward flow; negative values indicate inward flow.

APPENDIX F

SURFACE RUNOFF

Introduction

Tables F-1 through F-12 present chlorinated hydrocarbons concentrations measured in individual samples of storm and dry-weather runoff collected by SCCWRP between fall 1970 and spring 1976; Tables F-13 through F-16 summarize mass emission rate data not covered in Volume I. The last section of this appendix describes our analysis of suspended particulate material (silt) in runoff, and observed relationships between these results, discharge rate, and chlorinated hydrocarbon concentrations.

Particle Size Studies

Laboratory Procedures

To more completely evaluate our results for chlorinated hydrocarbons in surface runoff, using the technique of pipette analysis we investigated particle size distributions in the 1972-73 Los Angeles River samples.

The theory of the pipette analysis of silt is based on the settling velocity of the particles, usually computed on the basis of Stokes' law. In the pipette method, one withdraws a small volume of the silt suspended in aqueous solution, and weighs the residue following evaporation. The depth of removal of the samples and the times are determined by tables computed by the applicable Stokes' Law equation. Detailed derivations of the theory and tables can be found in the standard text on the subject by Krumbein and Pettijohn (1938). Excellent procedural information is provided by Folk (1959) and in a manual prepared by the Allan Hancock Foundation (unpublished). This later manual was the one closely follwed in this study; details are provided below.

Samples of runoff which had been collected in one gallon dark brown bottles were stored in the laboratory for several months prior to analysis. Thus the sediment should have had time to completely settle out. The bottles were marked at the water level for volume determination.

40 ml aliquots from each bottle were taken for total dissolved solids determination. The samples were dried in 50 ml beakers in an oven with final drying for a period of at least 1 hour at 110°C. Identical drying and weighing procedures were followed throughout the analysis.

The supernatent water was carefully siphoned from the samples leaving about 300 ml of water above the sediment in the sample bottles. The remaining water and sediment was transferred to a 62 µ seive to separate the sand and large particles from the silt. The material was washed with dispersing agent (2.5 g Calgon/liter) to assist in this separation. This was continued until the solution showed no signs of turbidity. The solution passing through the sieve was saved for the silt analysis below. The material remaining on the sieve was carefully washed with distilled water to remove the dispersing agent, then dried and reported as the fraction 62 µ. It should be noted that some organic material was present in this fraction. (Gross non-representative "litter" such as leaves and twigs were removed, however).

The silt solution was transferred to a 1,000 ml graduated cylinder and brought to 1,000 ml final volume by addition of the dispersant solution. The solution was agitated for 2 minutes and the withdrawal of 40 ml aliquots of the suspension was began at this time and depth intervals dictated by the appropriate table published by Guy (1969). The sampling was continued to the extent necessary to determine silt sizes down to 1 µ.

After the last sample, the solution was allowed to settle for several days to allow all sediment to settle, and a final 40 ml aliquot was taken to determine the weight of the dispersant present in the samples. This weight of the dispersant in the solution was subtracted from each of the above dried samples to give the weight of sediment in each of the samplings.

In the case of the first Los Angeles River storm runoff series (December 4-7, 1972) only 1 liter of the sample was available for analysis; thus the amount of silt was not sufficient to provide a satisfactory detailed analysis. Furthermore, it was considered necessary to destroy organic material as evidenced by algal growth in some of the samples. This was accomplished by treating the filtered residue with hot concentrated nitric acid twice prior to final determination of the "inorganic total suspended solids" reported in the data; these are the TSS results used in subsequent comparisons.

For some of the analysis reported for the second and fourth storm series, February 27 - March 1 and March 11 - March 12, 1973 respectively, it was necessary to use samples which had been treated with hexane as they were originally intended for chlorinated hydrocarbon analysis. These samples are so identified in the tables of results. For the dry weather flow samples, the amount of silt was too low for detailed analysis and in many cases a large amount of algae was present in the samples. Thus the samples were given the same treatment with concentrated nitric acid as the first Los Angeles River series, described above.

Results

The results of the dissolved and suspended solids measurements in the four collection series of Los Angeles River storm runoff, and the dry weather flows, are presented in Tables F-17 to F-21. We have made statistical analyses seeking significant correlations between the pertinent variables for each of the storms; corresponding levels of significant correlation are indicated in Figures F-1 to F-4. Figure F-5 summarizes all the correlations which were found to be statistically significant in storm series one (1) through four (4) at the 0.01 or 0.05 level.

These results do not appear to indicate any strikingly consistent relationships, with one or two exceptions. In three out of the four storms, concentrations of total DDT and total suspended solids are significantly correlated; similarly, in three out of four storms, 1254 PCB and flow rate are significantly correlated. This is consistent with our previous observations that chlorinated hydrocarbons concentrations often appeared to be roughly proportional to TSS concentration and rate of fow.

These results indicate that most of the suspended sediments and trace organics are transported during periods of initial peak flow in storm runoff. Therefore, for determination of mass emission rates, such periods require the most intensive sampling. The results summarized in Figure F-5 support the importance of suspended sediments in this transport, at least for total DDT.

TABLE F-1

Concentrations (µg/l) of chlorinated hydrocarbons measured by Stoner Laboratories (Cambell, Ca.) in "water" and "silt" fractions of storm runoff grab samples collected by SCCWRP along the southern California coast, November 28-30, 1970. Dissolved and particulate phases separated by Whatman GF/B filter disc.

Runoff Channel	Silt (g/l)	DDT	DDE	DDD	Dieldrin	Chlordane	PCB*1242
Ventura R.							
R-1							
Water		0.08	0.02	0.03	0.01	-	-
Silt	4.04	0.04	0.05	0.09	0.03	0.27	-
R-2							
Water		-	-	-	-	0.02	-
Silt	1.22	-	-	-	-	0.12	-
Santa Clara R.							
R-1							
Water		-	-	-	-	0.01	-
Silt	16.5	0.04	0.05	0.11	-	0.11	-
R-2							
Water		-	-	-	-	-	0.07
Silt	3.86	0.04	0.03	0.04	-	0.06	-
Calleguas Ck.							
R-1=							
Water		-	0.04	-	-	-	-
Silt	3.14	0.06	0.10	0.09	-	-	-
Ballona Ck.							
R-1							
Water		0.12	0.07	0.03	-	0.20	-
Silt	0.27	0.13	0.03	0.02	0.03	0.32	-
R-2							
Water b		0.04	0.02	0.01	0.11	0.17	-
Silt	0.86	0.32	0.39	-	-	2.5	-

* 1254 PCB not detected in any samples

TABLE F-1 cont.

Runoff Channel	Silt (g/1)	DDT	DDE	DDD	Dieldrin	Chlordane	PCB*1242
Los Angeles R.							
R-1							
Water		0.07	0.02	-	-	0.13	0.15
Silt	2.72	1.0	0.65	1.5	0.29	3.3	-
R-2							
Water		0.05	0.01	0.01	0.03	-	0.18
Silt	1.02	0.12	0.08	0.12	0.01	0.37	-
San Gabriel R.							
R-1							
Water		-	0.02	0.01	0.01	0.08	-
Silt	0.32	0.29	0.07	0.09	0.01	0.54	-
R-2							
Water		-	-	-	-	-	-
Silt	1.06	-	-	-	-	0.37	-
Santa Ana R.							
R-1							
Water		0.18	0.08	0.06	0.02	0.20	-
Silt	8.62	0.46	0.26	0.57	0.09	1.4	-
R-2							
Water		-	-	-	0.01	-	-
Silt	2.50	0.09	0.10	0.13	0.02	0.19	-
San Diego R.							
R-1							
Water		0.01	-	-	-	-	-
Silt	2.09	0.08	0.01	0.01	0.01	0.40	-

* 1254 PCB not detected in any samples

TABLE F-2

Concentrations (µg/1) of chlorinated hydrocarbons in Santa Clara River storm runoff. December 1971.

Collection Date	PST Time	Flow (cfs)	TSS (mg/1)	p,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT*	Dieldrin	PCB 1242	PCB 1254
Dec. 22	0930	16	135	<0.010	<0.009	<0.031	0.025	0.014	<0.070	<0.080
Dec. 22	1830	2.1	7,628	<0.010	0.083	0.046	0.134	0.008	<0.120	<0.130
Dec. 23	0030	62	3,565	<0.010	0.063	0.049	0.117	0.004	<0.160	<0.170
Dec. 23	1600	489	1,604	<0.010	0.051	0.048	0.068	<0.001	<0.170	<0.180
Dec. 24	0700	293	510	<0.010	0.018	0.040	0.063	0.009	<0.200	<0.200
Dec. 24	1300	1,200	31,650	<0.010	0.088	0.170	0.263	0.028	<0.170	<0.180
Dec. 24	1900	4,425	16,780	<0.010	0.031	0.067	0.103	0.004	<0.130	<0.130
Dec. 25	0100	3,250	9,106	<0.010	0.103	0.120	0.228	0.004	<0.100	<0.190
Dec. 25	0700	1,625	5,489	<0.010	0.045	0.054	0.104	0.003	<0.100	<0.120
Dec. 25	1900	1,068	3,737	<0.010	0.062	0.120	0.187	0.022	<0.240	<0.260
Dec. 26	0700	2,950	19,166	<0.010	0.034	0.093	0.132	<0.001	<0.280	<0.300
Dec. 26	1900	774	235	<0.010	<0.003	0.011	0.018	0.004	<0.054	<0.100
Dec. 27	0700	6,140	38,130	<0.010	0.058	0.170	0.233	0.039	<0.370	<0.400
Dec. 28	0700	1,422	3,694	<0.010	0.043	0.120	0.168	0.016	<0.150	<0.160

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* For calculations of total DDT, inequalities of DDT metabolites were replaced by one-half the upper limit.

TABLE F-3

Concentrations (µg/1) of chlorinated hydrocarbons in Ballona Creek storm runoff, November - December 1971.

Collection Date	PST Time	Flow (cfs)	TSS (mg/1)	p,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT*	Dieldrin	PCB	
									1242	1254
Nov. 11	1900	112	750	0.950	0.840	<0.024	1.80	2.00	<0.390	1.70
Nov. 11	2120	259	1,301	0.830	0.730	1.10	2.66	1.50	<0.100	2.30
Nov. 12	2335	81	335	0.460	0.270	<0.024	0.742	0.500	<1.00	0.850
Nov. 12	0230	132	506	0.700	0.610	<0.038	1.33	0.310	<0.800	0.500
Nov. 12	0450	1,170	273	0.430	0.340	<0.024	0.782	0.220	<0.620	0.340
Nov. 12	1200	23	32	0.078	0.060	<0.006	0.141	0.080	<0.100	0.065
Dec. 21	2115	8.8	13	<0.003	0.014	0.007	0.022	0.010	<0.024	0.049
Dec. 22	0215	492	603	<0.120	<0.100	0.390	0.500	0.490	<2.00	3.00
Dec. 22	0415	264	248	0.050	0.071	0.099	0.220	0.014	<0.310	0.370
Dec. 22	0615	4,620	300	0.084	<0.026	0.116	0.213	0.228	<0.400	0.500
Dec. 22	0815	3,740	207	0.022	0.054	0.084	0.160	0.015	<0.370	0.230
Dec. 22	2230	14	150	<0.007	<0.018	0.052	0.064	0.001	<0.059	<0.042

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* For calculations of total DDT, inequalities of DDT metabolites were replaced by one-half the upper limit.

TABLE F-4

Concentrations (µg/l) of chlorinated hydrocarbons in Los Angeles River storm runoff, October - December 1971.

Collection Date	PST Time	Flow (cfs)	TSS (mg/l)	p,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT*	Dieldrin	PCB 1242	PCB 1254
Oct. 25	1200	225	813	0.427	0.290	0.186	0.903	0.169	<0.100	0.300
Oct. 25	1400	200	600	0.404	0.308	0.169	0.881	0.149	<0.100	0.400
Oct. 25	1615	152	357	0.206	0.182	0.090	0.478	0.105	<0.100	0.200
Oct. 25	1800	126	276	0.233	0.212	0.085	0.530	0.069	<0.100	0.100
Oct. 25	2030	88	189	0.146	0.108	0.077	0.331	0.075	<0.100	0.100
Oct. 26	0830	45	83	0.053	0.039	0.026	0.118	0.036	<0.020	0.040
Nov. 11	2030	49	648	0.493	0.174	<0.005	0.670	0.210	4.00	1.00
Nov. 12	0030	72	530	0.500	0.150	<0.005	0.652	0.320	3.40	2.50
Nov. 12	0230	ND**	ND**	0.472	0.331	0.136	0.939	0.795	6.40	3.30
Nov. 12	0415	215	193	0.235	0.041	0.151	0.427	0.033	0.140	0.140
Nov. 12	0615	205	79	0.152	0.062	0.046	0.260	0.340	0.630	0.380
Nov. 12	1030	1,212	353	0.334	0.260	0.202	0.796	0.499	0.890	0.690
Nov. 12	2245	248	28	0.150	0.130	0.060	0.340	0.050	<0.160	<0.240
Dec. 22	0300	36	10	<0.005	<0.005	<0.005	0.008	0.074	<0.100	0.520
Dec. 22	0500	57	124	0.170	0.050	0.050	0.270	0.103	0.410	0.350
Dec. 22	0700	160	128	<0.050	0.200	<0.050	0.250	0.118	14.0	<1.00
Dec. 22	0900	12,430	717	<0.020	0.280	1.64	1.93	0.205	<1.90	2.70
Dec. 22	1500	2,970	451	<0.020	0.270	0.370	0.650	0.051	<0.250	<0.280
Dec. 22	2100	961	164	0.034	0.026	0.033	0.093	0.105	<0.100	<0.090
Dec. 23	1000	190	161	<0.020	0.130	0.130	0.270	0.060	<0.800	<0.240

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* For calculations of total DDT, inequalities of DDT metabolites were replaced by one-half the upper limit.

** No data

TABLE F-5

Concentrations (μg/1) of chlorinated hydrocarbon in Santa Ana River storm runoff, December 1971.

Collection Date	PST Time	Flow (cfs)	TSS (mg/1)	p,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT*	Dieldrin	PCB 1242	PCB 1254
Dec. 22	1030	526	3,047	0.110	0.071	0.140	0.321	0.120	ND**	2.40
Dec. 22	1430	60	1,508	<0.010	<0.014	0.064	0.076	0.051	ND	<0.230
Dec. 22	2030	23	115	<0.010	0.022	0.031	0.047	0.032	ND	<0.085
Dec. 24	1015	41	776	<0.010	<0.004	0.067	0.074	0.067	ND	<0.100
Dec. 24	1700	1,690	5,876	<0.024	<0.090	0.220	0.277	0.105	ND	<0.200
Dec. 24	1900	502	5,768	<0.022	<0.030	0.046	0.072	0.041	ND	<0.048
Dec. 25	0930	33	1,180	<0.005	<0.002	0.005	0.008	0.019	ND	<0.059
Dec. 25	2230	130	1,427	<0.005	<0.006	0.055	0.060	0.054	ND	<0.150
Dec. 26	1200	4.3	82	<0.005	<0.002	0.008	0.012	<0.003	ND	<0.060
Dec. 27	1415	435	735	<0.005	<0.018	0.070	0.082	<0.003	ND	<0.230

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* For calculations of total DDT, inequalities of DDT metabolites were replaced by one-half the upper limit.

** No data

TABLE F -6

Concentrations (μg/l) of chlorinated hydrocarbons in Los Angeles river storm runoff, December 4-7, 1972.

Collection Date	Time	Flow (cfs)	p,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	Dieldrin	PCB	
								1242*	1254
Dec. 4	1430	8275	0.05	0.23	0.28	0.56	0.20	2.20	1.12
Dec. 4	1530	6070	0.09	0.27	1.60	1.96	0.06	1.86	-
Dec. 4	1745	3051	0.03	0.26	0.37	0.66	0.16	1.09	0.63
Dec. 4	2115	1353	-	0.12	1.31	1.43	0.15	-	-
Dec. 5	1700	85	0.02	0.03	0.06	0.11	NR**	0.003	0.09
Dec. 6	2100	12	0.01	0.01	0.02	0.04	NR	0.004	0.06
Dec. 7	0200	4615	-	0.07	0.10	0.17	0.41	2.39	0.48
Dec. 7	0400	7069	0.04	0.08	0.18	0.30	0.02	1.04	0.29
Dec. 7	0630	3484	0.03	0.003	0.005	0.04	0.002	0.18	0.42
Dec. 7	0800	1940	0.02	0.15	0.10	0.27	0.007	0.60	0.33
Dec. 7	1400	589	0.15	0.11	0.07	0.33	0.004	0.44	0.22
Process Blank			<0.0001	0.001	<0.0001		<0.0001	<0.0004	<0.0016

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* 1242 PCB concentrations are upper limits only

** Not run

TABLE F-7

Concentrations (µg/l) of chlorinated hydrocarbons in Los Angeles river storm runoff, February 27 - March 1, 1973.

Collection Date	Time	Flow (cfs)	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	Dieldrin	PCB 1242*	PCB 1254
Feb. 27	2130	51	0.01	-	-	0.03	0.04	0.02	0.60	0.26
Feb. 28	0015	20,300	0.68	0.46	0.17	0.08	1.39	0.21	9.60	2.04
Feb. 28	0215	10,148	1.70	0.69	0.65	0.65	3.69	0.25	1.50	1.10
Feb. 28	0345	3,855	0.53	0.28	0.15	0.16	1.12	0.15	0.55	0.36
Feb. 28	0715	2,099	0.56	0.16	0.20	0.07	0.99	0.23	0.57	0.35
Feb. 28	1000	2,382	0.38	0.13	0.10	0.05	0.66	0.07	0.47	0.26
Feb. 28	1415	1,046	0.27	0.14	0.10	0.10	0.61	0.11	0.37	0.23
Feb. 28**	1815	692	0.16	0.08	0.05	-	0.29	0.06	0.32	0.21
Feb. 28**	1815	692	0.14	0.08	0.05	-	0.27	0.05	0.26	0.20
Feb. 28	2200	371	0.07	0.06	0.02	0.02	0.17	0.06	0.26	0.16
March 1	1100	134	0.01	0.02	0.01	0.01	0.05	0.03	0.10	0.08
Process Blank			<0.001	<0.001	<0.001	<0.001	<0.004	<0.001	0.05	<0.01

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* 1242 PCB concentrations are upper limits only

** Duplicate samples

TABLE F-8

Concentrations (µg/l) of chlorinated hydrocarbons in Los Angeles river storm runoff, March 6-9, 1973.

Collection Date	Time	Flow (cfs)	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	Dieldrin	PCB 1242*	PCB 1254
March 6	1315	90	0.06	0.03	0.01	0.004	0.10	0.06	0.09	0.12
March 6	1530	922	0.22	0.15	0.09	0.06	0.52	0.12	1.30	1.60
March 6	1930	2,935	0.23	0.25	0.06	0.07	0.61	0.07	0.72	0.59
March 7	0300	1,244	0.45	0.32	0.05	0.04	0.86	0.13	1.30	1.60
March 8	0845	62	0.01	0.02	0.01	0.01	0.05	0.03	0.09	0.07
March 8	1215	4,056	0.45	0.29	0.02	0.02	0.78	0.10	2.40	1.80
March 8**	1400	6,640	0.45	0.41	0.14	0.11	1.11	0.19	1.10	0.64
March 8**	1400	6,640	0.45	0.35	0.10	0.06	0.96	0.15	1.10	0.56
March 8**	1400	6,640	0.33	0.34	0.11	0.12	0.90	0.16	1.10	1.10
March 8	1845	2,392	0.56	0.31	0.11	0.16	1.14	0.16	0.58	0.48
March 8	2355	1,213	0.18	0.17	0.08	0.11	0.54	0.44	0.45	0.32
March 9	1515	146	0.04	0.04	0.03	0.02	0.13	0.08	0.15	0.15
Process Blank			<0.001	<0.001	<0.001	<0.001	<0.004	<0.001	<0.001	<0.002

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* 1242 PCB concentrations are upper limits only

** Triplicate samples

TABLE F-9

Concentrations ($\mu g/l$) of chlorinated hydrocarbons in Los Angeles River storm runoff, March 11-12, 1973.

Collection Date	Time	Flow (cfs)	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	Dieldrin	PCB 1242*	PCB 1254
March 11	0845	100	0.02	0.02	0.01	0.01	0.06	0.02	0.05	0.06
March 11	1045	3,578	0.11	0.15	0.10	-	0.36	0.07	17.00	2.50
March 11	1200	4,024	0.31	0.31	0.13	0.06	0.81	0.12	1.50	1.00
March 11**	1330	2,222	0.35	0.23	0.16	0.13	0.87	0.11	0.64	0.62
March 11**	1330	2,222	0.45	0.33	0.15	0.05	0.98	0.11	0.84	0.76
March 11	1500	2,032	0.38	0.32	0.09	0.10	0.89	0.08	0.54	0.45
March 11	2100	1,200	0.23	0.22	0.06	0.04	0.55	0.12	0.38	0.34
March 12	0400	1,095	0.22	0.13	0.06	0.02	0.43	0.05	0.80	0.33
March 12	1545	387	0.15	0.10	0.06	0.03	0.34	0.06	0.13	0.20
Process Blank			<0.001	<0.001	<0.001	<0.001	<0.004	<0.001	<0.001	<0.003

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* 1242 PCB concentrations are upper limits only

** Duplicate samples

TABLE F-10

Chlorinated hydrocarbon concentrations (μg/l) measured at SCCWRP and BML in a grab sample of Los Angeles River storm runoff collected March 8, 1973 (1400 hours).

	SCCWRP					BML			
Compound	R-1	R-2	R-3	Ave	Blank	R-1	R-2	R-3	Ave
p,p'-DDT	0.45	0.45	0.33	0.41	<0.001	0.59	0.55	0.66	0.60
o,p'-DDT	0.41	0.35	0.34	0.37	<0.001	-	-	-	-
p,p'-DDE	0.14	0.10	0.11	0.12	<0.001	0.25	0.20	0.28	0.24
o,p'-DDE	-	-	-	-	-	-	-	-	-
p,p'-DDD	0.11	0.06	0.12	0.10	<0.001	-	-	-	-
o,p'-DDD	-	-	-	-	-	-	-	-	-
Total DDT	1.1	0.96	0.90	0.99	<0.004	0.84	0.75	0.94	0.84
Dieldrin	0.19	0.15	0.16	0.17	<0.001	-	-	-	-
1242 PCB	-	-	-	-	-	-	-	-	-
1254 PCB	0.64	0.56	1.1	0.77	<0.002	1.1	1.1	1.2	1.1
Total PCB	0.64	0.56	1.1	0.77	<0.002	1.1	1.1	1.2	1.1

TABLE F-11

Mean concentrations (μg/l) of chlorinated hydrocarbons in dry weather flow via selected drainage basins, Southern California Bight, 1973.*

Channel & Basin No.	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	Dieldrin	1242 PCB	1254 PCB	Total PCB
Santa Barbara Group** (r-1)	0.015	0.002	0.026	0.024	0.067	0.002-0.003	0-0.04	0.02	0.02-0.06
Ventura (r-2)	0.002	0.002	0-0.001	0-0.001	0.004-0.006	0.004	0-0.04	0.02	0.02-0.06
Ballona Ck. (r-8)	0.004-0.006	0.009-0.010	0.004-0.005	0-0.002	0.017-0.023	0.052		0.04-0.06	0.04-0.06
Los Angeles R. (r-10)	0.004	0.004	0.003	0.14	0.156	0.12	0-0.78	0.12	0.12-0.90
San Gabriel R. (r-11)	0.011	0.010	0.003	0.001	0.025	0.017	0-0.09	0.05	0.05-0.14
Coyote Ck. (r-12)	0.017	0.020	0.011	0.009	0.057	0.017	0-0.06	0.08	0.08-0.14
San Juan Ck. (r-14)	0.007	0.002	0.001	0.002	0.012	0.002	0-0.02	0.01	0.01-0.03
San Luis Rey (r-15)	0.008	0.006+	0.006	0.007	0.027	0.008	0-0.57	0.01	0.01-0.58
San Diego R. (r-16)	0.015	0.009	0.004++	0.010	0.038	0.005	0-0.62	0.08	0.08-0.70

* Basins shown in Figure 1

** Concentrations presented are the means of the Arroyo Grande R., Santa Ynez R. and Santa Ynez R. and the Ventura R.

+ No value for San Luis Rey: Used average of r-14 and r-16

++ No value for San Diego R.: Used average of r-14 and r-15

TABLE F-12

Concentrations (µg/l) of chlorinated hydrocarbons in Los Angeles River storm runoff, February 4-11, 1976.

Date	Time	Est.Flow (cfs)	Total DDT	1242 PCB	1254 PCB
2/4	1400	200	0.48	0.26	1.1
2/5	1930	300	0.40	0.02	0.05
2/6	1000	2,900	0.60	0.48	0.67
2/6	1130	2,300	0.21	0.19	0.21
2/6	1245	1,700	0.42	0.44	0.60
2/6	1515	1,000	0.03	0.07	0.07
2/6	1900	600	0.05	0.09	0.18
2/6	2200	1,600	0.46	0.18	0.89
2/6	2400	1,800	0.42	0.20	0.94
2/7	1700	450	0.15	0.06	0.15
2/7	2330	1,500	0.24	0.13	0.40
2/8	0900	1,800	0.22	0.06	0.35
2/9	1400	3,000	0.54	0.06	0.47
2/9	1900	2,800	0.64	0.24	0.92
2/11	0830	100	0.03	0.01	0.04

TABLE F-13

Estimated mass emission rates (MER) of chlorinated hydrocarbons via storm runoff, Southern California Bight, 1971-72.[a]

Basin No.	Channel	Volume (10^6cu m)	Total DDT Mean Conc. (µg/1)	Total DDT MER (kg/yr)	Dieldrin Mean Conc. (µg/1)	Dieldrin MER (kg/yr)	Total PCB Mean Conc. (µg/1)	Total PCB MER (kg/yr)
R-2	Ventura R.[b]	2.7		0.68-0.70		0.02		0-0.78
R-3	Santa Clara R.	36.0	0.25-0.26	9.00-9.36	0.009	0.32	0-0.29	0-10.4
R-4	Calleguas Ck.[b]	5.9		1.48-1.53		0.05		0-1.71
R-5	Malibu Ck.[b]	2.5		0.62-0.65		0.02		0-0.72
R-6	Topanga Ck.[b]	0.5		0.12-0.13		0.005		0-0.14
R-7	Sawtelle-Westwood Ch.[c]	-		-		-		-
R-8	Ballona Ck.	18.1	0.38-0.40	6.88-7.24	0.20	3.62	0.47-0.91	8.51-16.5
R-9	Dominguez Ch.[c]	-		-		-		-
R-10	Los Angeles R.	67.3	0.93	62.6	0.16	10.8	2.12-2.97	143-200
R-11	San Gabriel R.[d]	12.5		11.6		2.00		26.5-37.1
R-12	Coyote Ck.[c]	14.3		5.43-5.72		2.86		6.72-13.0
R-13	Santa Ana R.	5.6	0.16-0.18	0.90-1.01	0.077	0.43	0.11-0.23	0.62-1.29
R-14	San Juan Ck.[e]	0.2		0.03-0.04		0.02		0.02-0.05
R-15	San Luis Rey[e]	0.4		0.06-0.07		0.03		0.04-0.09
R-16	San Diego R.[e]	0.1		0.02		0.008		0.01-0.02
	ALL AREAS	166		99.4-101		20.2		185-282[f]

[a] Basins shown on Figure 1, of Vol. I.
[b] PCB conc. est. from data for Santa Clara R.
[c] PCB conc. est. from data for Ballona Creek
[d] PCB conc. est. from data for the L.A. R.
[e] PCB conc. est. from data for the Santa Ana R.
[f] Est. MER for 1254 PCB only: 89.3-112 kg/yr.

TABLE F-14

Estimated chlorinated hydrocarbon mass emission rates (MER) via dry-weather surface runoff in the Bight, 1971-1972*.

Channel	Ref. Basin	Volume (10^6cu m)	TOTAL DDT Mean Conc. (µg/1)	TOTAL DDT MER (kg/yr)	DIELDRIN Mean Conc. (µg/1)	DIELDRIN MER (kg/yr)	TOTAL PCB Mean Conc. (µg/1)	TOTAL PCB MER (kg/yr)
Santa Barbara Group.	r-1		0.067		0.002- 0.003		0.02- 0.06	
Ventura R.	r-2	1.0	0.004- 0.006	0.004- 0.006	0.004	0.004	0.02- 0.06	0.02- 0.06
Santa Clara R.	r-1	0.7		0.05		0.001- 0.002		0.01 0.04
Calleguas Ck.	r-1	3.8		0.26		0.008- 0.011		0.08- 0.23
Malibu Ck.	r-1	2.8		0.19		0.006- 0.008		0.06- 0.17
Topanga Ck.	r-1	0.5		0.03		0.001- 0.002		0.01- 0.03
Sawtelle-Westwood Ch.	r-3	-		-		-		-
Ballona Ck.	r-3	10.0	0.017- 0.023	0.17- 0.23	0.052	0.52	0.04- 0.06	0.40- 0.60
Dominguez Ch.	r-3	-		-		-		-
Los Angeles R.	r-4	28.5	0.156	4.45	0.12	3.42	0.12- 0.90	3.42- 25.7
San Gab. R.	r-5	36.7	0.025	0.92	0.017	0.62	0.05- 0.14	1.84- 5.14
Coyote Ck.	r-6	7.5	0.057	0.43	0.017	0.13	0.08- 0.14	0.60- 1.05
Santa Ana R.	r-7 to 9	0	0.071	0	0.005	0	0.03- 0.43	0
San Juan Ck.	r-7	0.3	0.012	0.004	0.002	0.001	0.01- 0.03	0.003- 0.009

TABLE F-14 cont.

Channel	Ref. Basin	Volume (10^6cu m)	Total DDT Mean Conc. (µg/l)	Total DDT MER (kg/yr)	Dieldrin Mean Conc. (µg/l)	Dieldrin MER (kg/yr)	Total PCB Mean Conc. (µg/l)	Total PCB MER (kg/yr)
San Luis Rey	r-8	4.6	0.027	0.12	0.008	0.04	0.01-0.58	0.05-2.67
San Diego R.	r-9	3.9	0.038	0.15	0.005	0.02	0.08-0.70	0.31-2.73
ALL AREAS		100		6.78-6.84		4.77-4.78		6.80-38.4**

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* Using 1973 dry weather flow concentrations

** Estimated MER for PCB 1254 only: 6.8 kg/yr.

TABLE F-15

Estimated 1971-72 surface runoff MERs (kg/yr) of chlorinated hydrocarbons via storm and dry-weather flow to the Bight.

Type	Volume (10^6 cu m)	Total DDT	Dieldrin	PCB 1254*
Storm	166	99.4-101	20.2	89.3-112
Dry Weather	100	6.8	4.8	6.8
TOTAL	266	106-108	25.0	96.1-119
Dry Weather / Total	37.6%	6.3-6.4%	19.2%	5.7-7.1%

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* Estimated MER's (kg/yr) for Total PCB: Storm, 185-282; Dry Weather, 6.8-38.4; Total, 192-320.

TABLE F-16

Estimated chlorinated hydrocarbon mass emission rates (MER) via dry-weather surface runoff* in the Bight, 1972-1973.

Channel	Ref. Basin	Volume (10^6 cu m)	Total DDT Mean Conc. (µg/l)	Total DDT MER (kg/yr)	Dieldrin Mean Conc. (µg/l)	Dieldrin MER (kg/yr)	Total PCB Mean Conc. (µg/l)	Total PCB MER (kg/yr)
Santa Barbara Group	r-1		0.067		0.002-0.003		0.02-0.06	
Ventura R.	r-2	13.2	0.004-0.006	0.05-0.08	0.004	0.05	0.02-0.06	0.26-0.79
Santa Clara R.	r-1	0.1		0.007		0.0002-0.0003		0.002-0.006
Calleguas Ck.	r-1	6.4		0.43		0.01-0.02		0.13-0.38
Malibu Ck.	r-1	4.7		0.32		0.009-0.014		0.09-0.28
Topanga Ck.	r-1	1.2		0.08		0.002-0.004		0.02-0.07
Sawtelle-Westwood Ch.	r-3	3.1		0.05-0.07		0.16		0.12-0.19
Ballona Ck.	r-3	11.0	0.017-0.023	0.19-0.25	0.052	0.57	0.04-0.06	0.44-0.66
Dominguez Ch.	r-3	1.8		0.03-0.04		0.09		0.07-0.11
Los Angeles R.	r-4	26.7	0.156	4.17	0.12	3.20	0.12-0.90	3.20-24.0
San Gab. R.	r-5	36.9	0.025	0.92	0.017	0.63	0.05-0.14	1.85-5.17
Coyote Ck.	r-6	5.8	0.057	0.33	0.017	0.10	0.08-0.14	0.46-0.81
Santa Ana R.	r-7 to 9	0	0.071	0	0.005	0	0.03-0.43	0

TABLE F-16 cont.

Channel	Ref. Basin	Volume (10^6cu m)	Total DDT Mean Conc. (µg/l)	Total DDT MER (kg/yr)	Dieldrin Mean Conc. (µg/l)	Dieldrin MER (kg/yr)	Total PCB Mean Conc. (µg/l)	Total PCB MER (kg/yr)
San Juan Ck.	r-7	2.4	0.012	0.03	0.002	0.005	0.01- 0.03	0.02- 0.07
San Luis Rey	r-8	6.6	0.027	0.18	0.008	0.05	0.01- 0.58	0.07- 3.83
San Diego R.	r-9	7.1	0.038	0.27	0.005	0.04	0.08- 0.70	0.57- 4.97
ALL AREAS		127		7.06- 7.18		4.92- 4.94		7.30- 41.3*

* Estimated MER for PCB 1254 only: 7.3 - 7.6 kg/yr.

TABLE F-17

Concentrations (mg/l) of total dissolved solids (TDS) and total suspended solids (TSS) in Los Angeles River storm runoff: Dec. 4-7, 1972.

Date	Time	TDS	TSS (incl. organic)	TSS (inorganic)
Dec. 4	1430	105	1570	1237
Dec. 4	1530	132	1762	1442
Dec. 4	1745	130	1258	997
Dec. 4	2115	148	697	533
Dec. 5	1700	492	196	126
Dec. 6	2100	795	29	12
Dec. 7	0200	125	230	160
Dec. 7	0400	168	477	362
Dec. 7	0630	108	312	226
Dec. 7	0800	185	538	338
Dec. 7	1400	672	211	152

TABLE F-18

Concentrations (mg/l) of total dissolved solids (TDS), total suspended solids (TSS), and suspended solids in eight estimated size classes; Los Angeles River storm runoff: February 27 - March 1, 1973.

				Suspended Solids							
Date	Time	TDS	TSS	>62µ	62-31 µ	31-16 µ	16-8 µ	8-4 µ	4-2 µ	2-1 µ	<1 µ
Feb. 27	2130*	-	42	-	-	-	-	-	-	-	-
Feb. 28	0015*	-	687	92	89	172	82	79	63	56	54
Feb. 28	0215*	-	1476	72	422	195	290	134	133	122	108
Feb. 28	0345*	-	907	114	102	169	152	102	106	93	69
Feb. 28	0715*	-	2149	227	144	542	326	258	271	207	175
Feb. 28	1000**	175	1445	-	-	-	-	-	-	-	-
Feb. 28	1415	158	2712	440	318	380	308	288	305	395	280
Feb. 28	1815	205	4490	2718	62	-	-	288	265	423	322
Feb. 28	2200	262	3940	2715	15	38	144	260	258	160	350
March 1	1100	562	128								

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* Sample preserved with hexane

** Sediment analysis followed extraction procedure

TABLE F-19

Concentrations (mg/l) of total dissolved solids (TDS), total suspended solids (TSS), and suspended solids in eight estimated size classes; Los Angeles River storm runoff: March 6-9, 1973.

				Suspended Solids							
Date	Time	TDS	TSS	>62 μ	62-31 μ	31-16 μ	16-8 μ	8-4 μ	4-2 μ	2-1 μ	<1 μ
March 6	1315	728	300	277	-	-	-	-	-	-	-
March 6	1530	402	4133	1503	600	568	522	435	-	-	180
March 6	1930	252	4415	1687	573	473	540	417	313	230	182
March 7	0300	232	2083	748	180	315	470	190	25	25	130
March 8	0845	658	500	312	-	8	-	17	13	142	-
March 8	1215	215	3509	2171	270	175	225	172	13	142	-
March 8	1400	118	2990	108	862	435	485	315	128	368	-
March 8	1845	122	3565	1201	37	683	364	310	247	538	-
March 8	2355	200	1909	62	115	315	270	250	466	504	-
March 9	1515	398	460	1	0	25	8	0	273	624	-

TABLE F-20

Concentrations (mg/l) of total dissolved solids (TDS), total suspended solids (TSS), and suspended solids in eight estimated size classes; Los Angeles River storm runoff: March 11-12, 1973

				Suspended Solids							
Date	Time	TDS	TSS	>62 µ	62-31 µ	31-16 µ	16-8 µ	8-4 µ	4-2 µ	2-1 µ	<1 µ
March 11	0845	778	230	86	-	3	7	3	-	133	-
March 11	1045	170	825	62	110	136	127	120	240	60	-
March 11	1200	142	2315	85	428	580	368	292	150	412	-
March 11	1330	140	2584	37	697	643	350	240	213	404	-
March 11	1500*	135	2810	45	472	533	377	406	364	613	-
March 11	2100	-	449	-	-	-	-	-	-	-	-
March 12	0400	150	1180	15	60	160	103	194	273	375	-
March 12	1545	365	826	6	28	24	16	142	105	505	-

* Sediment analysis followed extraction procedure

TABLE F-21

Concentrations (mg/l) of total dissolved solids (TDS) and total suspended solids (TSS) in dry weather flow from southern California channels: 1973.

	Date	TDS	TSS (incl. organic)	TSS (inorganic)	Date	TDS	TSS (incl. organic)	TSS (inorganic)
Montano de Oro Creek	-	-	-	-	Sept 16	688	3	1
Arroyo Grande	May 27	1105	38	28	Sept 15	882	2	1
Santa Ynez River	May 27	1108		1	-	-	-	-
Ventura River	May 26	978	3	1	Sept 15	-	5	1
Ballona Creek	May 30	1315	95	43	Sept 26	2442	65	30
Los Angeles River	May 30	925	28	14	Oct. 2	678	96	5
San Gabriel River	May 30	795	41	2	Sept 26	845	21	4
Coyote Creek	July 1	-	50	10	Sept 26	1655	63	29
San Juan Creek	May 29	1830	12	1	Sept 9	2192	9	<1
San Luis Rey	May 29	1450	30	13	Sept 9	1500	113	-
San Diego River	May 27	1462	95	-	Sept 8	1840	29	4

	Flow	Total DDT	PCB 1254	Dieldrin	Total Dissolved Solids	Total Suspended Solids
Flow	■		0.05			
Total DDT		■				0.05
PCB 1254	0.05		■			0.01
Dieldrin				■		
Total Dissolved Solids					■	
Total Suspended Solids		0.05	0.01			■

FIGURE F-1. Matrix of significance levels where statistically significant correlation are observed for Los Angeles river storm runoff. Storm 1, December 4-7, 1972.

		FLOW	TOTAL DDT	PCB 1254	DIELDRIN	TOTAL DISSOLVED SOLIDS	TOTAL SUSPENDED SOLIDS	PARTICAL SIZE (μ)							
								>62	31-62	16-31	8-16	4-8	2-4	1-2	<1
FLOW		■		0.01								0.05	0.05		
TOTAL DDT			■		0.01										
PCB 1254		0.01		■											
DIELDRIN			0.01		■										
TOTAL DISSOLVED SOLIDS						■									
TOTAL SUSPENDED SOLIDS							■					0.05	0.05		0.01
PARTICAL SIZE (μ)	>62							■							0.05
	31-62								■						
	16-31									■					
	8-16										■				
	4-8	0.05					0.05					■	0.01	0.05	0.01
	2-4	0.05					0.05					0.01	■	0.05	0.05
	1-2											0.05	0.05	■	
	<1						0.01	0.05				0.01	0.05		■

FIGURE F-2. Matrix of significance levels where statistically significant correlation are observed for Los Angeles river storm runoff. Storm 2, February 27 - March 1, 1972.

		FLOW	TOTAL DDT	PCB 1254	DIELDRIN	TOTAL DISSOLVED SOLIDS	TOTAL SUSPENDED SOLIDS	PARTICAL SIZE(μ)							
								>62	31-62	16-31	8-16	4-8	2-4	1-2	<1
FLOW		■	0.05			0.05									
TOTAL DDT		0.05	■			0.01	0.05			0.05					
PCB 1254				■				0.05							
DIELDRIN					■										
TOTAL DISSOLVED SOLIDS		0.05	0.01			■	0.05								
TOTAL SUSPENDED SOLIDS			0.05			0.05	■	0.01		0.01	0.05	0.01			0.05
PARTICAL SIZE (μ)	>62			0.05			0.01	■							
	31-62								■						
	16-31		0.05				0.01			■	0.05	0.01			
	8-16						0.05			0.05	■	0.01			
	4-8						0.01			0.01	0.01	■			
	2-4												■		
	1-2													■	
	<1														■

FIGURE F-3. Matrix of significance levels where statistically significant correlation are observed for Los Angeles river storm runoff. Storm 3, March 6-9, 1973.

		FLOW	TOTAL DDT	PCB 1254	DIELDRIN	TOTAL DISSOLVED SOLIDS	TOTAL SUSPENDED SOLIDS	PARTICAL SIZE (μ)							
								>62	31-62	16-31	8-16	4-8	2-4	1-2	<1
	FLOW	■		0.05											
	TOTAL DDT		■				0.01		0.01	0.01	0.01	0.01			
	PCB 1254	0.05		■											
	DIELDRIN				■					0.05	0.05				
	TOTAL DISSOLVED SOLIDS					■						0.05			
	TOTAL SUSPENDED SOLIDS		0.01				■		0.01	0.01	0.01	0.01			
PARTICAL SIZE (μ)	>62							■							
	31-62		0.01				0.01		■	0.01	0.05				
	16-31		0.01		0.05		0.01		0.01	■	0.01	0.05			
	8-16		0.01		0.05		0.01		0.05	0.01	■	0.05			
	4-8		0.01			0.05	0.01			0.05	0.05	■		0.05 →	
	2-4												■		
	1-2											0.05		■	
	<1											↓			■

FIGURE F-4. Matrix of significance levels where statistically significant correlation are observed for Los Angeles river storm runoff. Storm 4, March 11-12, 1973.

								PARTICAL SIZE (μ)							
		FLOW	TOTAL DDT	PCB 1254	DIELDRIN	TOTAL DISSOLVED SOLIDS	TOTAL SUSPENDED SOLIDS	>62	31-62	16-31	8-16	4-8	2-4	1-2	<1
	FLOW	■	3	1 2 4		3						2	2		
	TOTAL DDT	3	■		2	3	1 3 4		4	3 4	4	4			
	PCB 1254	1 2 4		■			1	3							
	DIELDRIN		2		■				4	4					
	TOTAL DISSOLVED SOLIDS	3	3			■	3					4			
	TOTAL SUSPENDED SOLIDS		1 3 4	1		3	■	3	4	3 4	3 4	2 3 4	2		2
PARTICAL SIZE (μ)	>62			3			3	■							2
	31-62		4				4		■	4	4				
	16-31		3 4		4		3 4		4	■	3 4	3 4			
	8-16		4		4		3 4		4	3 4	■	3 4			
	4-8	2	4			4	2 3 4			3 4	3 4	■	2	2 ④ →	2
	2-4	2					2					2	■	2	2
	1-2											2 ④	2	■	
	<1						2	2				2 ↓	2		■

FIGURE F-5. Matrix indicating those correlations for which a statistical significance is observed in Los Angeles river storm runoff: 1972-1973. Storm number indicated.

APPENDIX G

AERIAL FALLOUT

Introduction

Here we describe a number of tests conducted since 1973 to develop our technique for collecting chlorinated hydrocarbons deposited via dry aerial fallout. Table G-5 and G-6 list results for all constituents identified in samples from individual stations and sampling periods.

Scraping Recovery and Process Blanks

In view of the importance of aerial inputs which this research has uncovered, we have evaluated in detail the results of an intensive survey conducted in fall 1974. Twenty collections were conducted at stations throughout the Bight; each included a fresh blank plate which was taken to the site and sprayed and scraped in exactly the same manner as the sampling plate. In addition, following the usual triple spraying and scraping procedure to obtain the sample from the glass plate collector, this process was repeated to test recovery of the procedure. We assume that, as a first order approximation, the "efficiency" of the first triplicate scraping set (1st) is given by the following formula:

$$\% \text{ Efficiency} = 100\text{x} \frac{\text{1st Triplicate Scraping} - \text{Blank}}{\text{1st + 2nd Triplicate Scraping} - \text{2Blank}}$$

We have also calculated the "percent blank" as:

$$\% \text{ Blank} = 100\text{x} \frac{\text{Blank}}{\text{1st Triplicate Scraping}}$$

Our results are listed in Table G-1. These data indicate that: (1) Our standard procedure of triplicate spraying and scraping does provide very high recovery (approximately 100%) of the sample in the field; (2) the scraped plates are sufficiently clean to begin the next sampling without bias; (3) process blanks usually are insignificant.

Retention Efficiency of Oiled Plates

In addition to the question of sample recovery from the oiled plate collectors, we have been concerned with their efficiencies of retention over time for the fallout constituents under investigation. Therefore, early in the program we initiated several investigations into the reliability of this technique.

TABLE G-1. Sample recovery efficiency of first triplicate scraping set and percent blank values obtained from the detailed aerial fallout survey conducted throughout the Bight 9-21 October 1974.

Station	Recovery Efficiency (%)		Process Blank (%)	
	Total DDT	1254 PCB	Total DDT	1254 PCB
Jalama	100	100	2.7	3.1
Refugio	100	103	0.7	6.5
Carpinteria	100	-	0.8	46
Zuma	100	100	0.4	1.7
Pt. Vincente	92	87	1.3	20
Cabrillo	78	56	0.6	18
Clemente Beach	97	98	0.2	4.0
Imperial Beach	90	97	0.9	7.3
Santa Cruz I.-1	96	98	4.4	5.2
Santa Cruz I.-2	100	100	3.0	4.3
Santa Cruz I.-3	102	100	3.4	6.3
Anacapa I.-1	99	100	1.8	5.0
Anacapa I.-2	100	104	0.8	5.2
Anacapa I.-3	100	100	0.6	2.1
San Nicholas I.-1	100	100	0.7	4.2
San Nicholas I.-2	99	97	1.2	4.8
San Nicholas I.-3	100	99	0.9	1.6
Santa Catalina I.-1	98	94	0.9	0.3
Santa Catalina I.-2	97	101	1.1	1.9
Santa Catalina I.-3	98	100	1.5	4.1
MEDIAN	99	100	0.9	4.6
MEAN	97	97	1.4	7.6
95% C.L.	± 2.5	± 4.8	±0.5	±4.9

In April 1974, we conducted a detailed series of experiments in an effort to estimate the collection efficiency of the glass plate system for sampling chlorinated hydrocarbons in dry aerial fallout. Fourteen plates were sprayed with mineral oil and exposed over a period of 8 days on the roof of a private home near the coast of Santa Monica Bay, far from any known point source of contamination. The plates were divided into four groups. The samples were removed from three of the plates daily; these were then repositioned. A second set of three plates was sampled and repositioned every other day. A third set of four plates was sampled and repositioned on the fourth day, and the remaining four plates were sampled on the eighth day.

Five chlorinated hydrocarbons were identified in these samples: p,p'-DDT, o,p'-DDT, p,p'-DDE, p,p'-DDD, and 1254 PCB. In Table G-2, average values for the total quantity of each of these compounds accumulated over the 8 days are given as a function of collection frequency.

These data indicated that collection efficiency decreased with duration of plate exposure. To determine if this loss of efficiency was a linear process that we could correct for by linear recovery factors, we calculated corresponding regression lines and their correlation coefficients (Table G-3). Most of the results were statistically significant at greater than the 95 percent confidence level; p,p'-DDE and p,p'-DDD results were significant at the 94 percent level. Because our fallout samplers are generally exposed for 1 week before the sample is collected, the collection efficiency factor for a given constituent was taken as the ratio of the best-fit cumulative value for a 7-day exposure to the extrapolated value for a zero-day exposure. Standard 7-day collection efficiencies (and their 95 percent confidence intervals) calculated from these data are listed below. We normalized our fallout survey results to standard weeks (Monday through Sunday) and divided by 7 to obtain an estimated average daily flux at a given station for that week. The flux values then were corrected by the efficiency factors shown below:

Dry aerial fallout 7-day collection efficiencies with 95 percent confidence intervals.

Fallout Constituent	Collection Efficiency (%)	Confidence Interval
p,p'-DDT	60	56-64
o,p'-DDT	64	50-82
p,p'-DDE	36	11-81
p,p'-DDD	63	42-92
1254 PCB	54	43-66

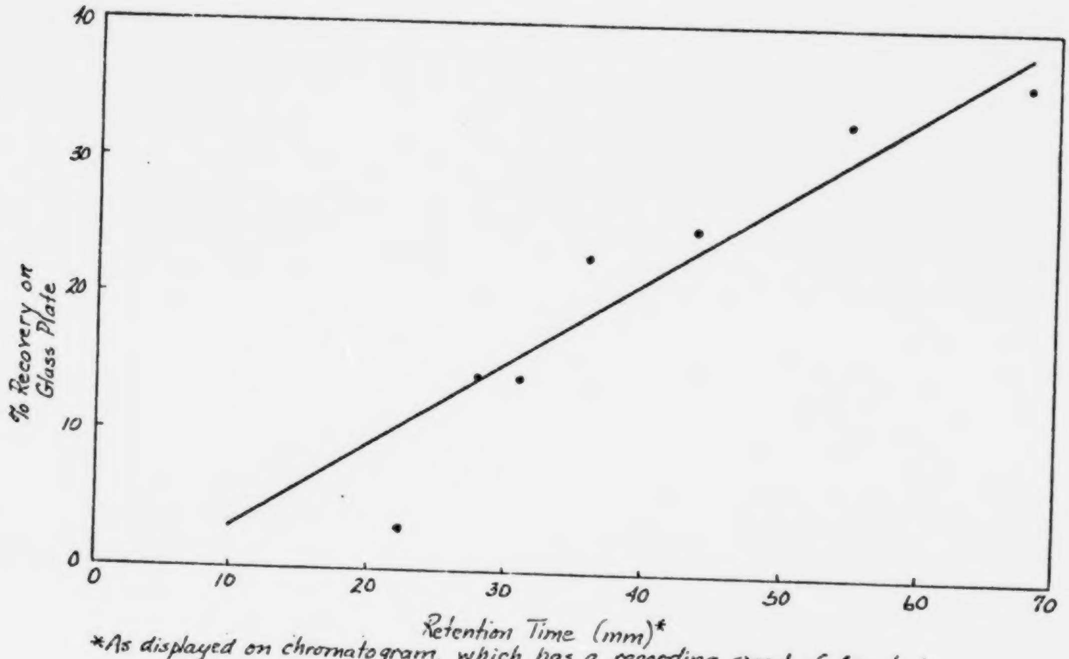
Table G-2. Cumulative average quantities (ng) of chlorinated hydrocarbons measured over an 8-day period (3-11 April 1974) on four sets of collection plates sampled at different frequencies.

Collection Frequency	3-5 Apr	3-7 Apr	3-9 Apr	3-11 Apr
p,p'-DDT				
1-day	190	300	384	540
2-day	158	263	345	509
4-day	-	235	-	454
8-day	-	-	-	312
o,p'-DDT				
1-day	52	90	121	181
2-day	46	81	114	172
4-day	-	68	-	166
8-day	-	-	-	110
p,p'-DDE				
1-day	29	64	91	134
2-day	17	48	63	94
4-day	-	37	-	74
8-day	-	-	-	39
p,p'-DDD				
1-day	28	62	104	180
2-day	23	46	81	157
4-day	-	51	-	163
8-day	-	-	-	104
1254 PCB				
1-day	60	140	218	401
2-day	46	90	161	352
4-day	-	104	-	327
8-day	-	-	-	195

Table G-3. Correlation coefficients for 8-day collection series of chlorinated hydrocarbons in dry aerial fallout.

Constituent	Correlation Coefficient*
p,p'-DDT	-0.99
o,p'-DDT	-0.97
p,p'-DDE	-0.94
p,p'-DDD	-0.94
1254 PCB	-0.98

*For the two degrees of freedom applicable here, correlation coefficients of ±0.95 and ±0.99 correspond to the 95 and 99 percent confidence limits, respectively.



*As displayed on chromatogram, which has a recording speed of 1cm/min.

Figure G-1. Recovery of Aroclor 1242 from spiked glass plate.

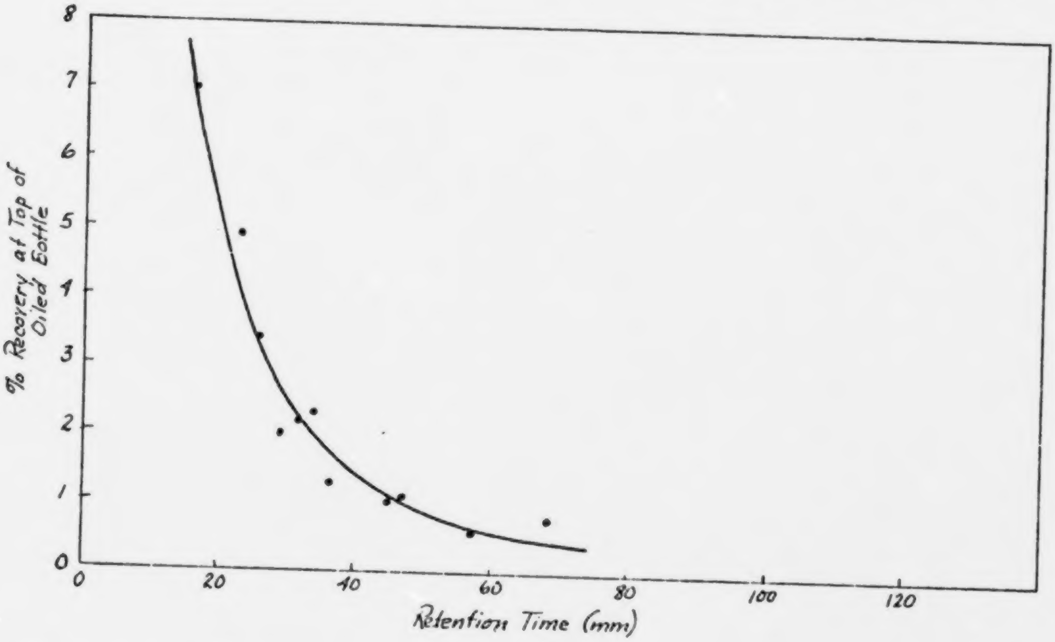


Figure G-2. Recovery of PCB's (Aroclors 1242 and 1254) from top of oil-spiked glass jug.

Recently, we have conducted experiments to determine if additional recovery could be accomplished by collecting at a lower temperature. A nonoiled aluminum pan sampler resting on a block of dry ice was exposed for 2 to 3 days next to our regular oil-on-glass collection plate. The ratios of the quantities of total DDT and 1254 PCB collected by the cooled pan and the uncooled, oiled plate are summarized below:

Test No.	Ratio, Cooled to Uncooled, Total DDT	Ratio, Cooled to Uncooled, 1254 PCB
1	1.00	0.98
2	0.56	0.47
3	0.84	0.76
4	0.81	0.41
5	1.11	1.72
6	1.29	0.68
Median	0.92	0.72
Mean ± S.E.	0.94 ± 0.10	0.84 ± 0.20

These results demonstrate that the oil-on-glass collection system used in our studies does provide a representative picture of the fallout rate of these chlorinated hydrocarbons onto the Bight. However, the volatility of certain constituents does interfere with the efficiency of this collection system, as described below.

Volatility Study

At the beginning of the fallout sampling program, several experiments on the retention of various chlorinated hydrocarbons by the glass plate collectors were conducted. The results of these experiments, such as the one described just above, indicated that, for the compounds with relatively low molecular weights (such as p,p'-DDE, and 1242 PCB), the flux values obtained from daily collections were considerably larger than the values obtained for weekly collections. This suggested significant losses of the lighter compounds through volatilization or some other process, such as decomposition via ultraviolet radiation. Thus, we investigated this phenomenon further.

Two compounds of interest with low recovery were Dieldrin and Aroclor 1242; 0.1 mg of each compound was added to 10 ml of a 17 percent mineral oil in hexane solution (by volume). The mixtures were placed on fallout sampling plates and allowed to stand for a period of 4 days on the Project's roof. The results of the experiment for 1242 PCB are illustrated in Figure G-1. The low recovery and the linear relationship between retention time and percent recovery again suggests that the problem with detection of Aroclor 1242 in fallout is one of volatility or photodecomposition. The recovery from the sample spiked with Dieldrin was 26 percent, and observations made elsewhere (Prof. D. Crosby, Univ. of California at Davis, pers. comm.) suggests that this may be caused principally by the photodecomposition of Dieldrin.

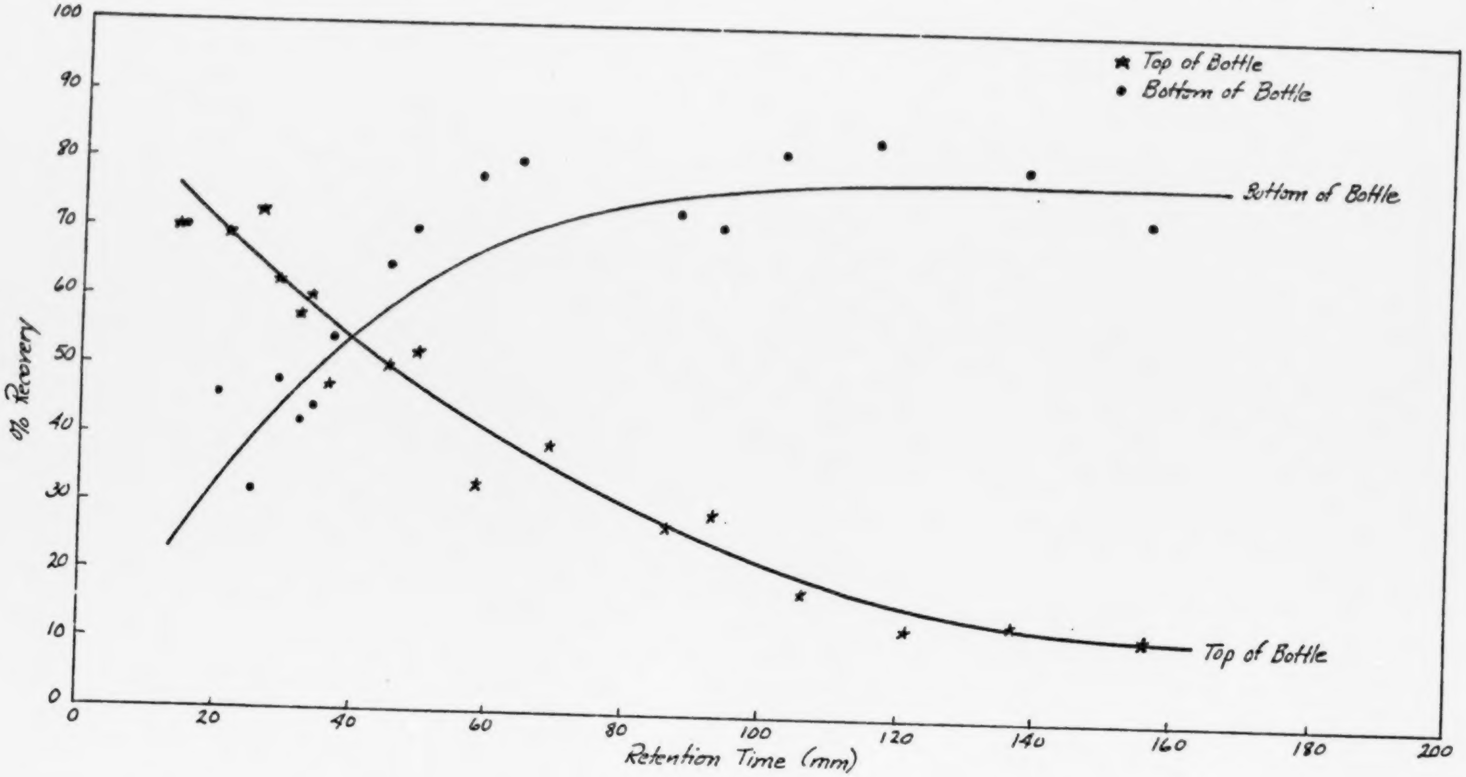


Figure G-3. Recovery of PCB's (Aroclors 1242 and 1254) from hexane-spiked glass jug.

It should be noted that 0.1 mg is an especially heavy spike. The chromatograms essentially show only the compounds that were spiked and not any decomposition peaks. This would suggest that decomposition by ultraviolet radiation is unlikely.

In another experiment, Aroclor 1242 standard was added to mineral oil and hexane. This mixture was then placed in a 1-gallon glass jug that had been previously sprayed with mineral oil and hexane. The hexane was allowed to evaporate, and the jug was sealed with a cap lined with aluminum foil; the jug was then placed on the Project's roof for a period of 6 days, after which the jug was cut about 5 cm from the bottom, the top half was rinsed with hexane, and the sample was analyzed. The results of this experiment are illustrated in Figure G-2. These data indicate that recovery from the upper section of the jug increases with decreasing retention time on the gc column.

One problem with the second experiment was that the mineral oil seemed to be trapping the PCB's, as the oil was about 0.5 cm thick in the bottom of the jug. To more closely model the fallout sampling field conditions, the amount of oil was reduced in a third experiment. Both Aroclor 1242 and 1254 were utilized as spikes to get a wider range of molecular weights. Again, a 1-gallon glass jug was used for the experiment. The jug was sprayed lightly with a mineral oil/hexane mixture, and the PCB spike in hexane was added. The hexane was allowed to evaporate, and the jug was sealed with an aluminum-foil-lined cap and placed on the Project's roof. After 6 days, the jug was cut about 5 cm above the bottom, and each section was analyzed. Our results (Figure G-3) illustrate the relatively poor retention observed for 1242 PCB, characterized by lower molecular weights than most of the DDT residues and 1254 PCB (which are adequately sampled by the oiled plate collectors).

Saponification

Part of the SCCWRP cleanup procedure for certain types of samples involves a dehydrohalogenation step commonly termed saponification. This procedure also can be useful in supporting the identification of certain peaks on a chromatogram. Therefore, we utilized it on a number of low-level fallout samples to check our identification of two important DDT constituents.

The extracted sample is refluxed with alcoholic potassium hydroxide for a thirty minute period and the mixture then is extracted using hexane to recover the products of the saponification reaction. This results in a dehydrohalogenation of the isomers of DDT and DDD. When DDT is dehydrohalogenated it is converted to DDE. Similarly, DDD is dehydrohalogenated to form DDMU* (Figure G-4).

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*The IUPAC name for p,p'-DDMU is: 1- chloro-2, 2-bis (p-chlorophenyl) ethylene.

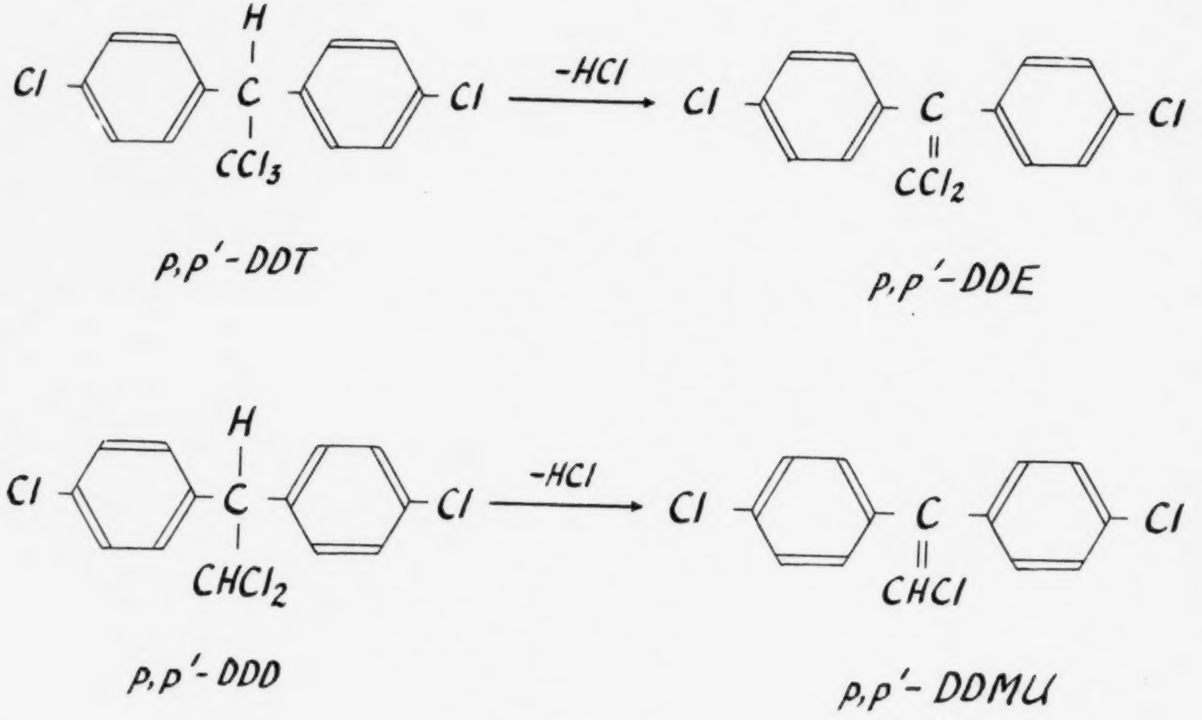

Figure G-4. Structural changes upon dehydrohalogenation (saponification) of p,p'-DDT and p,p'-DDD.

The chlorine bonded to the aromatic rings does not react; thus p,p'-DDT is converted to p,p'-DDE and o,p'-DDT is converted to' o,p'-DDE upon dehydrohalogenation.

On a molar basis, the amount (A) of p,p'-DDE found in the saponified samples should equal the sum (B) of p,p'-DDT and p,p'-DDE measured in the unsaponified samples, if the quantification of these compounds is correct. Values for the percent dehydrohalogenation of"yield" (A/B x 100), which should equal 100, have been obtained for a number of low-level fallout samples collected in October 1974. The results are listed below:

Station	Yield (%)
Refugio Beach	104
Santa Cruz Island	113
Santa Cruz Island	102
Anacapa Island	134
San Nicholas Island	88
San Nicholas Island	103
Santa Catalina Island	81
Santa Catalina Island	132
Average ± S.E.	107 ± 6.7

It should also be possible to obtain dehydrohalogenation yields in the case of o,p'-DDD and p,p'-DDD being converted to o,p'-DDMU and p,p'-DDMU, respectively. But in our samples the regions of the chromatograms were o,p'-DDMU and p,p'-DDMU appear are obscured. However, the average yield is quite satisfactory in light of the relatively low levels of chlorinated hydrocarbons in these samples; this lends confidence to our results for p,p'-DDT and p,p'-DDE, two of the principal components of fallout DDT in the Bight.

Wind Transport

Analysis of wind data indicates that wind transport is a more important parameter than wind direction in these aerial fallout studies. Relative transport is defined as that product of average velocity and frequency of winds in a given direction. Figures G-5 to G-7 present monthly transport and direction rosettes for July, August, and September 1973 at Pt. Mugu, located near Port Hueneme north of Los Angeles. The representative rosettes for the combined three months are shown in Figure G-8 . Although the winds during this period predominantly are from the north, the effective transport is seen to be onshore, from the west.

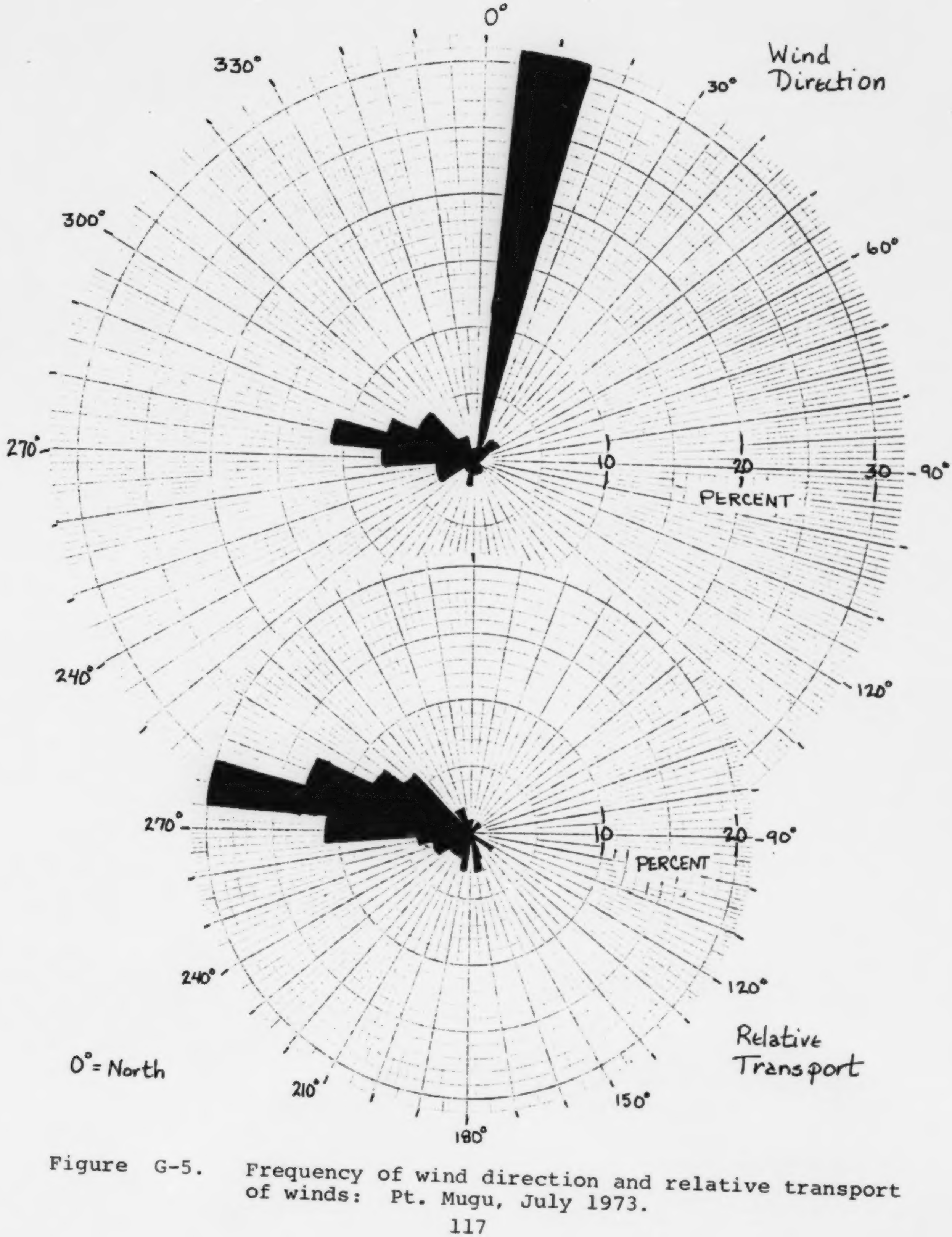

Figure G-5. Frequency of wind direction and relative transport of winds: Pt. Mugu, July 1973.

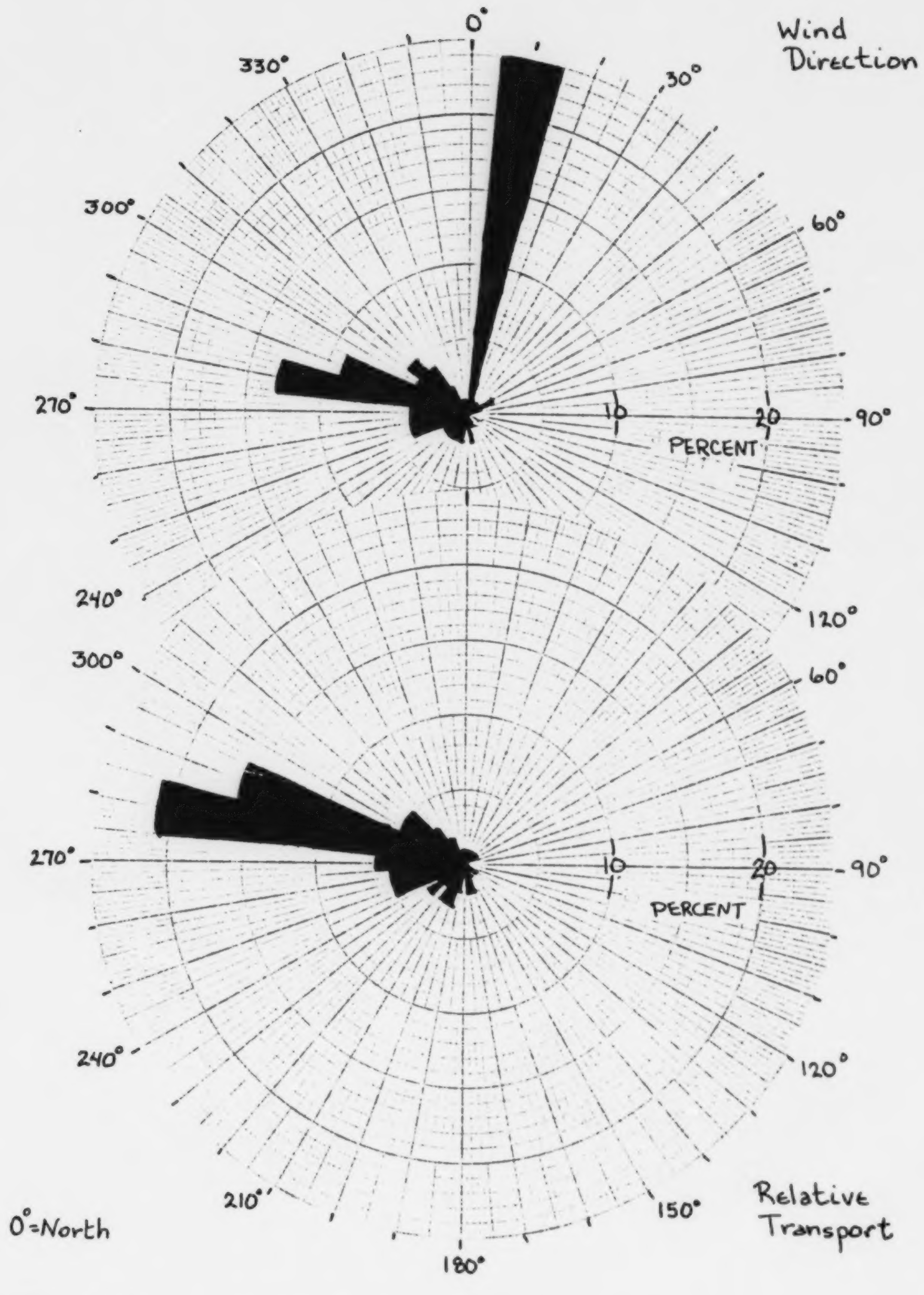

Figure G-6. Frequency of wind direction and relative transport of winds: Pt. Mugu, August 1973.

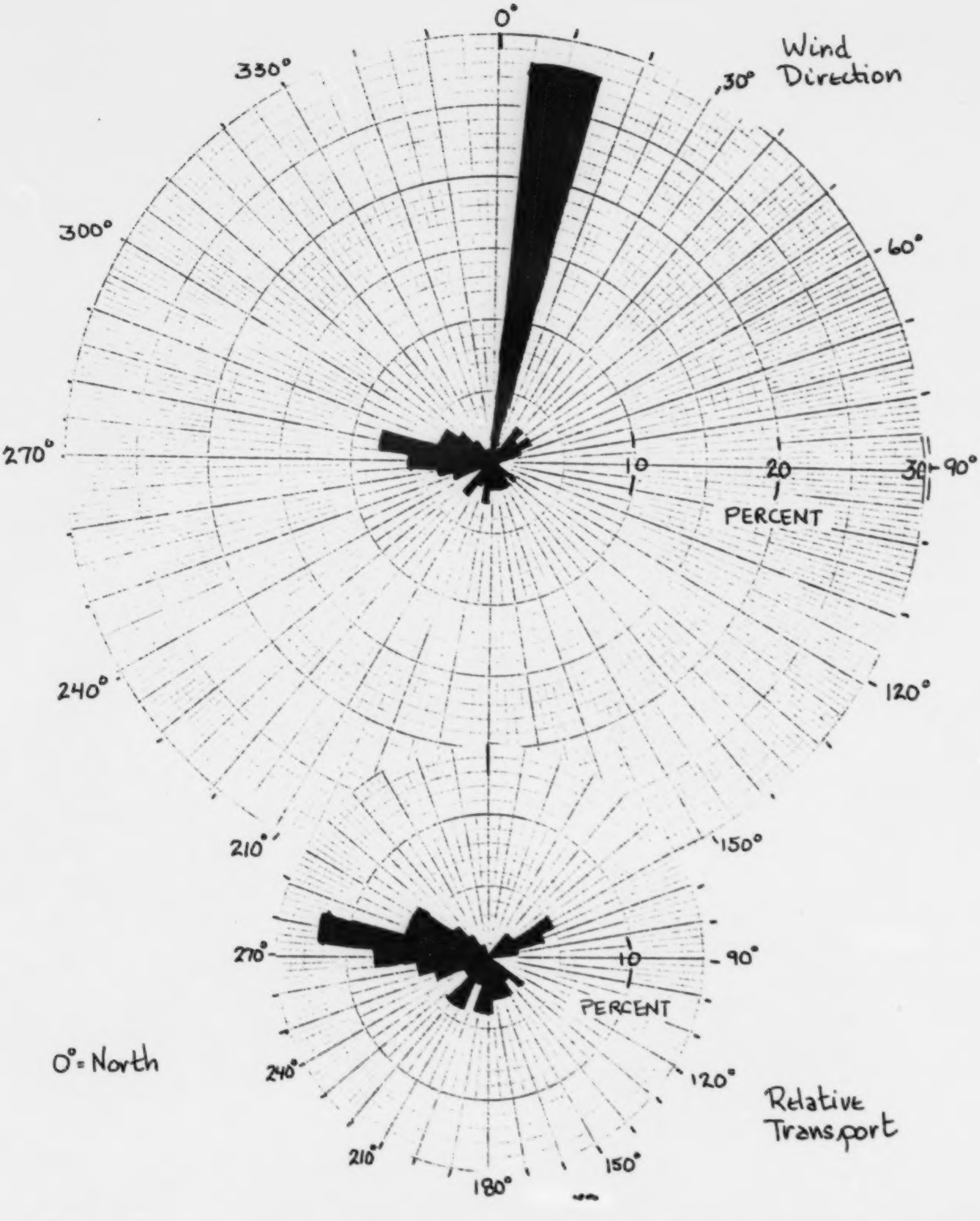

Figure G-7. Frequency of wind direction and relative transport of winds: Pt. Mugu, September 1973.

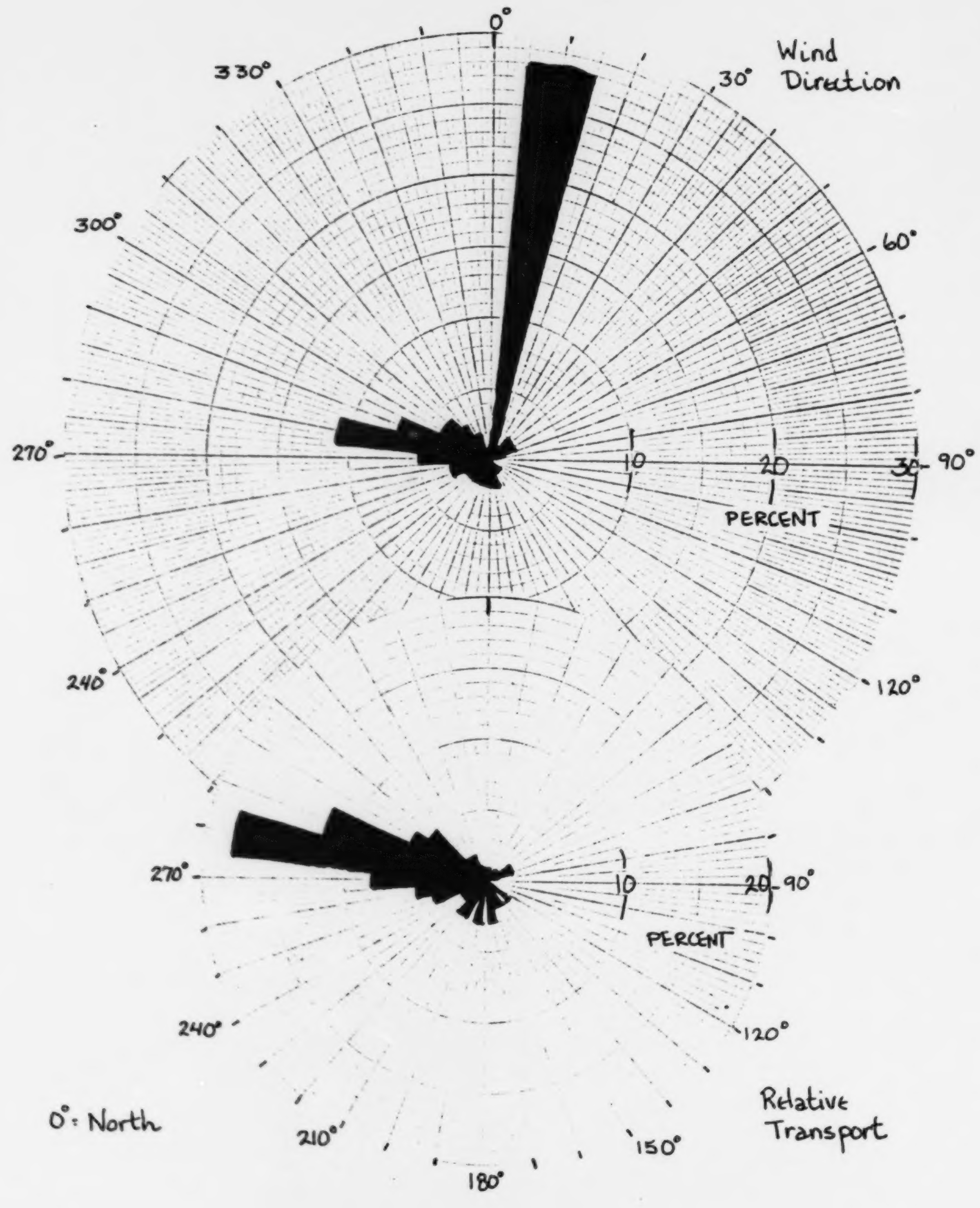

Figure G-8. Frequency of wind direction and relative transport of winds: Pt. Mugu, July-September, 1973.

TABLE G-5

Aerial fallout flux values (ng/m^2-day) for measurable DDT residues and 1254 PCB from coastal and island surveys conducted during 1973-76.

STATION: Jalama

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/30 - 8/5	14	3	-	-	17	111
8/6 - 8/12	14	5	-	-	19	57
8/13 - 8/19	12	6	3	-	21	17
9/3 - 9/9	49	25	3	-	77	93
9/10 - 9/16	37	25	3	-	65	93
9/17 - 9/23	58	38	6	-	102	87
9/24 - 9/30	51	19	3	-	73	82
Spring 1974*						
2/11 - 2/17	17	13	8	6	44	111
2/18 - 2/24	7	3	6	3	19	26
4/1 - 4/7	15	9	11	6	41	48
4/8 - 4/14	43	16	3	19	81	48
4/15 - 4/21	25	13	22	6	66	63
4/22 - 4/28	13	6	8	3	30	22
4/29 - 5/5	15	11	14	6	46	33
Fall 1974						
10/9 - 10/18	20	14	19	15	68	119
11/8 - 11/14	27	13	35	15	90	25
11/14- 11/22	13	6	19	5	43	22

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[*] Each value based on two replicate samples

TABLE G-5 cont.

STATION: Refugio

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/2 - 7/8	24	13	6	-	43	30
7/9 - 7/15	32	19	6	-	57	59
7/16 - 7/22	61	28	9	-	98	61
7/23 - 7/29	44	6	6	-	56	44
7/30 - 8/5	41	34	3	-	78	100
8/6 - 8/12	56	41	3	-	100	104
8/13 - 8/19	53	23	9	-	85	50
8/20 - 8/26	56	13	9	-	78	50
8/27 - 9/2	47	22	9	-	78	44
9/3 - 9/9	114	52	26	-	192	115
9/10 - 9/16	49	44	11	-	104	137
9/17 - 9/23	136	125	3	-	264	309
9/24 - 9/30	88	47	11	-	146	133
Spring 1974*						
2/4 - 2/10	82	16	100	16	214	39
2/11 - 2/17	40	16	33	13	102	35
2/18 - 2/24	47	22	22	21	112	6
3/25 - 3/31	5	2	3	2	12	13
4/1 - 4/7	48	17	19	16	100	18
4/8 - 4/14	133	48	92	40	313	65
4/15 - 4/21	125	42	89	38	294	68
4/22 - 4/28	87	31	39	25	182	30
4/29 - 5/5	48	23	36	16	123	50
Fall 1974						
10/9 - 10/18	64	39	50	48	201	110
11/8 - 11/14	95	33	76	49	253	275
11/14- 11/22	36	16	21	17	90	22

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* Each value based on two replicate samples.

TABLE G-5 cont.

STATION: Carpentieria

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/9 - 7/15	24	13	-	-	37	41
7/16 - 7/22	39	38	3	-	80	48
7/23 - 7/29	31	30	3	-	64	37
7/30 - 8/5	14	6	3	-	23	18
8/6 - 8/12	25	13	-	-	38	50
8/13 - 8/19	12	6	3	-	21	39
8/20 - 8/26	32	11	6	-	49	44
8/27 - 9/2	105	22	9	-	136	111
9/3 - 9/9	75	44	11	-	130	137
9/10 - 9/16	42	36	14	-	92	117
9/17 - 9/23	85	58	-	-	143	67
9/24 - 9/30	71	47	-	-	118	164
Spring 1974*						
2/4 - 2/10	7	5	8	3	23	59
2/11 - 2/17	17	8	14	5	44	91
3/11 - 3/17	48	31	69	25	173	52
3/18 - 3/24	57	28	44	35	164	48
4/1 - 4/7	7	3	6	3	19	9
4/8 - 4/14	37	27	111	32	207	39
4/15 - 4/21	50	25	58	27	160	82
4/22 - 4/28	28	9	17	8	62	37
4/29 - 5/5	47	19	28	16	110	52
Fall 1974						
10/9 - 10/16	47	35	31	50	163	35
11/14- 11/22	37	13	20	35	105	330
Fire 1975**						
11/24- 11/26	37	13	23	20	93	167
Post Fire 1975						
12/2 - 12/9	20	45	28	30	123	312
Spring 1976 (Santa Barbara)						
4/24 - 4/26	36	67	35	204	342	284
	140	221	13	56	430	486

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* Each value based on two replicate samples

** Samples taken during the Mill Fire, Tujunga and Arroyo Seco Districts, and the Village Fire, Mt. Baldy Ranger District, Angeles National Forest, 11/22 - 11/28, 1975.

TABLE G-5 cont.

STATION: Port Hueneme

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/2 - 7/8	86	42	6	-	134	68
7/9 - 7/15	100	44	11	-	155	87
7/16 - 7/22	278	84	31	-	393	238
7/23 - 7/29	292	89	29	-	410	298
7/30 - 8/5	51	88	6	-	145	235
8/6 - 8/12	114	50	-	-	164	196
8/13 - 8/19	147	53	-	-	200	226
8/20 - 8/26	71	28	3	-	102	114
8/27 - 9/2	47	22	3	-	72	82
9/3 - 9/9	258	103	34	-	395	264
9/10 - 9/16	231	166	26	-	423	1,024
9/17 - 9/23	261	166	29	-	456	756
9/24 - 9/30	746	245	166	-	1,157	1,062
Spring 1974*						
2/11 - 2/17	102	69	228	40	439	480
2/18 - 2/24	178	75	133	44	430	474
3/18 - 3/24	172	110	128	48	458	306
4/1 - 4/7	67	37	50	10	164	162
4/8 - 4/14	85	63	31	29	208	138
4/15 - 4/21	127	85	167	35	414	142
4/22 - 4/28	103	68	139	33	343	146
4/29 - 5/5	128	53	253	56	490	46
Fire 1975**						
11/24- 11/26	39	20	41	24	124	51
Post Fire 1975						
12/2 - 12/9	135	61	172	64	433	312

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* Each value based on two replicate samples

** Samples taken during the Mill Fire, Tujunga and Arroyo Seco Districts, and the Village Fire, Mt. Baldy Ranger District, Angeles National Forest, 11/22 - 11/28, 1975.

TABLE G-5 cont.

STATION: Point Dume (Zuma)

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/2 - 7/8	336	63	14	-	413	104
7/9 - 7/15	190	41	9	-	240	87
7/16 - 7/22	141	58	11	-	210	106
7/23 - 7/29	149	61	11	-	221	144
7/30 - 8/5	53	25	3	-	81	106
8/6 - 8/12	158	45	-	-	203	24
8/13 - 8/19	63	14	-	-	77	41
8/20 - 8/26	20	6	-	-	26	52
8/26 - 9/2	75	28	6	-	109	104
9/3 - 9/9	114	28	11	-	153	78
9/10 - 9/16	58	34	63	-	155	111
9/24 - 9/30	98	48	11	-	157	100
Spring 1974*						
2/4 - 2/10	90	25	33	17	165	96
2/11 - 2/17	60	25	39	13	137	93
2/18 - 2/24	35	13	14	10	72	113
3/18 - 3/24	90	28	17	19	154	74
3/25 - 3/31	22	6	22	5	55	35
4/1 - 4/7	57	27	28	13	125	85
4/8 - 4/14	165	45	31	24	265	20
4/15 - 4/21	87	27	50	22	186	111
4/22 - 4/28	78	39	53	17	187	98
4/29 - 5/5	92	25	31	16	164	57
Fall 1974						
10/9 - 10/17	102	62	70	92	327	237
11/8 - 11/14	46	67	80	72	365	196
Fire 1975**						
11/24- 11/26	40	13	23	34	110	151
Post Fire 1975						
12/2 - 12/9	68	27	50	48	193	78

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* Each value based on two replicate samples

** Samples taken during the Mill Fire, Tujunga and Arroyo Seco Districts, and the Village Fire, Mt. Baldy Ranger District, Angeles National Forest, 11/22 - 11/28, 1975.

TABLE G-5 cont.

STATION: Santa Monica

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/16 - 7/22	371	125	17	-	513	178
7/23 - 7/29	369	148	11	-	528	230
7/30 - 8/5	403	1,269	23	-	1,695	304
8/6 - 8/12	556	1,275	31	-	1,862	300
8/20 - 8/26	675	197	-	-	872	546
8/27 - 9/2	315	89	6	-	410	228
9/10 - 9/16	249	188	-	-	437	374
9/24 - 9/30	197	134	14	-	345	235
Spring 1974*						
2/4 - 2/10	215	67	50	67	399	656
2/11 - 2/17	127	109	106	125	467	972
2/18 - 2/24	352	108	103	130	693	850
2/25 - 3/3	335	83	72	100	590	604
3/11 - 3/17	352	94	61	73	580	406
3/18 - 3/24	317	78	50	59	504	337
3/25 - 3/31	297	69	42	51	459	300
4/1 - 4/7	218	91	89	106	504	1,038
4/8 - 4/14	460	134	150	162	906	848
4/15 - 4/21	182	84	75	70	411	798
4/22 - 4/28	127	64	53	48	292	698
4/29 - 5/5	293	45	97	57	492	564
Fall 1974						
11/8 - 11/16	305	120	145	200	770	609
11/16- 11/22	329	137	150	263	879	672
Fire 1975						
11/24- 11/26	170	76	52	184	482	561
Post Fire 1975						
12/2 - 12/9	106	41	-	125	272	326

---

* Each value based on two replicate samples

** Samples taken during the Mill Fire, Tujunga and Arroyo Seco Districts, and the Village Fire, Mt. Baldy Ranger District, Angeles National Forest, 11/22 - 11/28, 1975.

TABLE G-5 cont.

STATION: Point Vicente

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
8/13 - 8/19	144	34	6	-	184	63
8/20 - 8/26	86	41	6	-	133	50
8/27 - 9/2	24	9	3	-	36	20
9/3 - 9/9	42	11	9	-	62	39
9/10 - 9/16	149	102	6	-	257	188
9/24 - 9/30	108	63	17	-	188	89
Spring 1974*						
2/4 - 2/10	203	25	44	8	280	72
2/11 - 2/17	185	42	69	22	318	89
2/18 - 2/24	268	63	83	52	466	198
3/11 - 3/17	103	34	56	22	215	70
3/18 - 3/24	30	17	25	17	89	52
4/1 - 4/7	58	5	28	5	96	26
4/8 - 4/14	60	13	25	10	108	52
4/15 - 4/21	57	14	31	6	108	37
4/22 - 4/28	47	9	19	5	80	52
Fall 1974						
10/9 - 10/16	139	66	113	98	416	269
11/8 - 11/14	386	133	137	128	784	234
11/14- 11/22	301	110	119	122	652	289
Fire 1975**						
11/24- 11/26	561	125	188	128	1,002	269
Post Fire 1975						
12/2 - 12/9	247	81	258	127	713	302

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* Each value based on two replicate samples

** Samples taken during the Mill Fire, Tujunga and Arroys Seco Districts and the Village Fire, Mt. Baldy Ranger District, Angeles National Forest, 11/22 - 11/28, 1975.

TABLE G-5 cont.

STATION: Cabrillo Beach (San Pedro Harbor)

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
8/13 - 8/19	261	80	37	-	378	130
8/20 - 8/26	112	34	17	-	163	104
8/27 - 9/2	125	34	11	-	170	114
9/3 - 9/9	124	34	11	-	169	114
9/10 - 9/16	805	117	34	-	956	268
9/24 - 9/30	380	123	111	-	614	168
Spring 1974*						
2/4 - 2/10	587	159	200	60	1,006	441
2/11 - 2/17	577	169	261	78	1,085	364
2/18 - 2/24	927	220	314	102	1,563	876
3/11 - 3/17	207	50	194	59	510	366
3/18 - 3/24	68	44	131	54	297	372
4/1 - 4/7	457	98	164	73	792	248
4/8 - 4/14	433	111	186	83	813	285
4/15 - 4/21	187	59	97	35	378	285
4/22 - 4/28	145	52	86	29	312	298
Fall 1974						
10/9 - 10/16	743	289	281	241	1,554	767
11/8 - 11/16	1,769	559	416	262	3,006	5,567
11/16- 11/22	1,473	428	675	295	2,871	1,281
Fire 1975** (Long Beach)						
11/24- 11/26	176	95	107	191	569	282
Post Fire 1975 (Long Beach)						
12/2 - 12/9	940	202	300	289	1,731	632

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[*] Each value based on two replicate samples

[**] Samples taken during the Mill Fire, Tujunga and Arroyo Seco Districts, and the Village Fire, Mt. Baldy Ranger District, Angeles National Forest, 11/22 - 11/28, 1975

TABLE G-5 cont.

STATION: Outer San Pedro Harbor

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/2 - 7/8	339	155	57	-	551	200
7/9 - 7/15	339	155	57	-	551	200
7/16 - 7/22	378	91	80	-	549	185
7/23 - 7/29	441	75	126	-	642	183
7/30 - 8/5	344	61	51	-	456	142
8/6 - 8/12	325	58	46	-	429	116
8/13 - 8/19	668	95	46	-	809	141
8/20 - 8/26	402	127	26	-	555	89
8/27 - 9/2	102	17	11	-	130	85
9/3 - 9/9	397	36	23	-	456	107
9/10 - 9/16	690	75	54	-	819	124

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* Each value based on two replicate samples

TABLE G-5 cont.

STATION: Newport

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/2 - 7/8	158	66	6	-	230	106
7/9 - 7/15	158	66	6	-	230	106
7/16 - 7/22	163	52	20	-	235	211
7/23 - 7/29	102	28	-	-	130	107
7/30 - 8/5	163	11	17	-	191	438
8/6 - 8/12	259	69	-	-	328	187
8/13 - 8/19	100	22	-	-	122	70
8/20 - 8/26	92	19	-	-	111	63
8/27 - 9/2	131	28	3	-	162	132
9/3 - 9/9	134	30	3	-	167	137
9/10 - 9/16	139	75	-	-	214	198
9/17 - 9/23	169	52	11	-	232	111
9/24 - 9/30	171	50	11	-	232	104
Spring 1974*						
2/4 - 2/10	197	75	117	54	443	304
2/18 - 2/24	383	84	94	49	610	252
3/11 - 3/17	105	47	42	25	219	56
3/18 - 3/24	50	72	25	35	182	56
3/25 - 3/31	8	-	-	-	8	9
4/1 - 4/7	237	50	83	32	402	114
4/8 - 4/14	310	38	39	27	414	178
4/15 - 4/21	105	28	28	13	174	148
4/22 - 4/28	70	23	22	19	134	79
4/29 - 5/5	122	34	36	25	217	85
Fall 1974						
11/7 - 11/14	304	66	117	77	564	281
11/14- 11/21	317	80	92	78	567	202
Fire 1975**						
11/24- 11/26	133	44	102	136	415	256
Post Fire 1975						
	135	61	172	64	432	312
Spring 1976						
3/23 - 3/26	72	28	56	47	203	200
	79	30	57	70	236	201
3/26 - 3/29	49	18	35	45	147	97
	54	28	51	54	187	286

TABLE G-5 cont.

STATION: Newport (continued)

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Spring 1976						
3/29 - 4/1	42	6	13	8	69	973
	61	3	17	9	90	307
4/16 - 4/19	29	1	6	5	41	-[+]
	26	2	15	5	48	-[+]
4/19 - 4/23	34	18	36	34	122	25
	43	15	37	19	114	66
4/23 - 4/26	73	30	33	55	191	84
	43	21	37	41	142	110
4/26 - 4/29	-[++]	-	-	-	-	110
	-	-	-	-	-	63
4/29 - 5/3	45	24	46	37	152	104
	68	24	36	36	164	75

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[*] Each value based on two replicate samples.

[**] Samples taken during the Mill Fire, Tujunga and Arroyo Seco Districts, and the Village Fire, Mt. Baldy Ranger District, Angeles National Forest, 11/22 - 11/28, 1975

[+] High blank values

[++] 4/26 - 4/29 Plates contaminated by bird droppings

TABLE G-5 cont.

STATION: San Clemente

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/30 - 8/5	64	44	-	-	108	124
8/6 - 8/12	129	41	6	-	176	112
8/13 - 8/19	83	45	23	-	151	83
8/20 - 8/26	66	38	-	-	104	122
8/27 - 9/2	98	25	6	-	129	148
9/3 - 9/9	108	28	6	-	142	148
9/10 - 9/16	207	66	29	-	302	130
9/17 - 9/23	163	66	11	-	240	118
9/24 - 9/30	159	66	11	-	236	118
Spring 1974*						
2/4 - 2/10	102	25	28	41	196	98
2/11 - 2/17	233	30	47	27	337	76
2/18 - 2/24	262	41	50	41	394	98
3/11 - 3/17	60	20	25	19	124	39
3/18 - 3/24	25	13	11	14	63	33
3/25 - 3/31	5	2	11	3	21	13
4/1 - 4/7	35	9	11	11	66	41
4/8 - 4/14	70	39	17	48	174	56
4/15 - 4/21	32	14	14	14	74	48
4/22 - 4/28	30	13	11	13	67	68
4/29 - 5/5	38	13	14	13	78	54
Fall 1974						
10/9 - 10/16	390	146	400	170	1,106	387
Fire 1975**						
11/24- 11/26	76	23	37	70	206	46
Post Fire 1975						
12/2 - 12/9	163	39	67	68	337	383

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* Each value based on two replicate samples

** Samples taken during the Mill Fire, Tujunga and Arroyo Seco Districts, and the Village Fire, Mt. Baldy Ranger District, Angeles National Forest, 11/22 - 11/28, 1975

TABLE G-5 cont.

STATION: Carlsbad

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/16 - 7/22	41	31	-	-	72	85
7/23 - 7/29	75	52	-	-	127	96
7/30 - 8/5	95	50	-	-	145	156
8/20 - 8/26	105	91	6	-	202	248
9/24 - 9/30	180	108	-	-	288	261
Spring 1974*						
2/4 - 2/10	83	33	39	43	198	116
2/11 - 2/17	142	38	67	51	298	93
3/11 - 3/17	62	27	50	33	172	17
4/15 - 4/21	27	22	25	25	99	24
Fall 1974						
11/7 - 11/21	29	34	39	78	180	119

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[*] Each value based on two replicate samples

TABLE G-5 cont.

STATION: La Jolla

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/2 - 7/8	17	9	3	-	29	56
7/9 - 7/15	22	23	-	-	45	67
7/16 - 7/22	17	6	9	-	32	44
7/23 - 7/29	12	8	-	-	20	52
7/30 - 8/5	22	16	-	-	38	74
8/6 - 8/12	12	9	-	-	21	39
8/13 - 8/19	10	5	3	-	18	35
8/20 - 8/26	20	3	3	-	26	11
8/27 - 9/2	14	8	-	-	22	24
9/3 - 9/9	59	45	9	-	113	141
9/10 - 9/16	56	20	-	-	76	80
9/17 - 9/23	24	13	3	-	40	59
9/24 - 9/30	58	3	-	-	61	20
Spring 1974*						
2/4 - 2/10	23	6	8	14	51	162
2/18 - 2/24	180	55	100	32	367	238
3/11 - 3/17	40	19	17	32	108	46
3/18 - 3/24	42	28	11	38	119	30
4/22 - 4/28	52	14	17	32	115	150
Spring 1976						
4/16 - 4/18	6	3	4	11	24	-**
	15	21	24	62	122	97

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* Each value based on two replicate samples

** Data point dropped; probable contamination

TABLE G-5 cont.

STATION: Imperial Beach

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/16 - 7/22	47	38	3	-	88	15
7/23 - 7/29	59	53	-	-	112	126
7/30 - 8/5	49	17	3	-	69	7
8/6 - 8/12	51	23	6	-	80	96
8/13 - 8/19	47	27	9	-	83	138
8/20 - 8/26	56	19	3	-	78	68
8/27 - 9/2	46	22	3	-	71	41
9/3 - 9/9	108	47	3	-	158	182
9/10 - 9/16	66	31	-	-	97	94
9/17 - 9/23	51	22	3	-	76	102
9/24 - 9/30	200	52	49	-	301	68
Spring 1974*						
2/4 - 2/10	237	39	67	29	372	87
2/11 - 2/17	85	23	31	73	212	96
2/18 - 2/24	120	45	67	48	280	172
3/11 - 3/17	58	48	61	33	200	61
3/18 - 3/24	38	19	8	13	78	33
3/25 - 3/31	20	6	8	2	36	13
4/1 - 4/7	25	17	28	6	76	46
4/8 - 4/14	75	17	39	16	147	109
4/15 - 4/21	35	20	25	17	97	89
4/22 - 4/28	38	17	17	10	82	33
4/29 - 5/5	30	13	14	8	65	32
Fall 1974						
10/9 - 10/16	102	87	91	189	469	289
11/7 - 11/14	180	189	167	467	1,003	541
11/14- 11/21	78	59	141	169	446	157

STATION: Ensenada, Mexico

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Fall 1973*						
9/3 - 9/10	593	243	50	-	886	270
9/10 - 9/17	232	94	14	-	340	100
9/17 - 9/24	727	262	33	-	1,022	230
9/24 - 10/1	368	178	28	-	574	172
10/1 - 10/8	160	112	6	-	278	152

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* Each value based on two replicate samples

TABLE G-5 cont.

STATION: Anacapa Island

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
8/6 - 8/12	68	31	11	-	110	107
8/13 - 8/19	71	34	9	-	114	167
8/20 - 8/26	54	28	6	-	88	141
9/3 - 9/9	31	13	6	-	50	78
9/10 - 9/16	25	19	6	-	50	70
9/17 - 9/23	293	106	40	-	439	291
9/24 - 9/30	293	106	37	-	433	287
Spring 1974*						
3/11 - 3/17	38	20	17	10	85	30
4/1 - 4/7	60	2	3	2	67	239
4/15 - 4/21	10	5	14	3	32	18
4/22 - 4/28	42	20	58	6	126	48
4/29 - 5/5	38	19	50	6	113	52
Fall 1974						
10/12- 10/19	32	22	80	23	157	74
	62	21	73	19	175	79
	74	48	116	43	281	206
11/2 - 11/16	79	34	251	26	390	136
	78	41	215	33	367	100
11/16- 11/23	20	7	23	5	55	20
	61	22	49	18	150	30

STATION: Santa Cruz Island

Summer 1973*						
8/6 - 8/12	20	9	6	-	35	48
8/13 - 8/19	10	5	3	-	18	28
8/20 - 8/26	119	8	-	-	127	74
8/27 - 9/2	49	6	3	-	58	50
9/3 - 9/9	17	6	3	-	26	39
9/10 - 9/16	17	6	3	-	26	33
9/17 - 9/23	17	6	3	-	26	33
9/24 - 9/30	78	20	11	-	109	70

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* Each value based on two replicate samples

TABLE G-5 cont.

STATION: San Nicolas Island

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/23 - 7/29	3	2	11	-	16	28
7/30 - 8/5	3	2	11	-	16	28
8/20 - 8/26	14	16	-	-	30	188
8/27 - 9/2	12	13	-	-	25	132
9/3 - 9/9	25	19	-	-	44	183
9/10 - 9/16	41	28	-	-	69	292
Spring 1974*						
2/4 - 2/10	23	9	22	6	60	78
2/11 - 2/17	23	13	28	5	69	166
2/18 - 2/24	50	9	28	-	87	316
2/25 - 3/3	50	9	22	3	84	266
3/4 - 3/10	12	11	14	6	43	141
3/11 - 3/17	15	9	14	6	44	114
3/8 - 3/24	17	9	17	10	53	70
3/25 - 3/31	13	8	8	3	32	82
4/1 - 4/7	13	8	8	3	32	82
4/8 - 4/14	5	3	6	2	16	18
4/15 - 4/21	5	3	6	2	16	18
4/22 - 4/28	15	19	8	6	48	141
4/29 - 5/5	13	19	6	5	43	132
Fall 1974						
10/10- 10/16	40	49	76	73	238	106
	33	26	41	36	136	64
	60	40	56	50	206	193
11/7 - 11/13	36	33	42	47	158	114
	61	39	42	44	186	85
11/13- 11/21	52	32	38	38	160	94
	29	23	23	54	129	69

STATION: San Miguel

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/23 - 7/29	20	16	34	-	70	224
7/30 - 8/5	12	9	34	-	55	122
8/6 - 8/12	24	14	14	-	52	126

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* Each value based on two replicate samples

TABLE G-5 cont.

STATION: Santa Catalina Island

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/16 - 7/22	14	8	-	-	22	52
7/23 - 7/29	22	13	-	-	35	61
7/30 - 8/5	39	19	-	-	58	78
8/6 - 8/12	46	19	-	-	65	194
8/13 - 8/19	3	2	-	-	5	11
8/20 - 8/26	22	13	6	-	41	156
8/27 - 9/2	34	14	-	-	48	204
9/3 - 9/9	20	6	-	-	26	142
Spring 1974*						
2/11 - 2/17	42	23	36	16	117	156
2/18 - 2/24	53	22	25	14	114	178
2/25 - 3/3	10	8	14	2	34	135
3/4 - 3/10	12	11	17	5	45	89
3/11 - 3/17	12	8	11	14	45	138
3/18 - 3/24	12	20	11	24	67	209
3/25 - 3/31	10	14	8	10	42	164
4/8 - 4/14	42	36	47	71	196	3,496+
4/15 - 4/21	12	20	8	17	57	398
4/22 - 4/28	17	13	3	5	38	89
4/29 - 5/5	12	17	3	11	43	191
Fall 1974						
10/10- 10/21	68	80	54	76	278	277
	76	77	66	52	271	713
	265	38	11	55	369	574
11/5 - 11/11	148	66	68	63	345	282
	94	53	45	37	229	244
11/11- 11/18	156	67	140	60	423	362
	157	69	74	50	350	18
Fire 1975**						
11/24- 11/26	38	101	57	-	196	62
Post Fire 1975						
12/2 - 12/9	55	20	42	35	152	45
	68	28	61	49	206	71

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* Each value based on two replicate samples

** Samples taken during the Mill Fire, Tujunga and Arroyo Seco Districts, and the Village Fire, Mt. Baldy Ranger District, Angeles National Forest, 11/22 - 11/28, 1975

+ Probable contamination

TABLE G-5 cont.

STATION: San Clemente Island

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
Summer 1973*						
7/23 - 7/29	-	2	1	-	5	26
7/30 - 8/5	-	2	1	-	5	26
8/6 - 8/12	5	3	-	-	8	26
8/13 - 8/19	3	3	-	-	6	18
8/20 - 8/26	2	2	1	-	7	4
Spring 1974*						
2/11 - 2/17	30	13	3	6	52	116
2/18 - 2/24	30	13	3	6	52	116
2/25 - 3/3	8	5	14	2	29	70
3/4 - 3/10	3	3	17	2	25	59
3/11 - 3/17	5	9	6	13	33	144
3/18 - 3/24	23	14	17	10	64	106
Fall 1974						
11/15- 11/20	38	27	47	28	140	58
	47	28	49	33	157	58
Spring 1976						
3/15 - 3/17	-	-	54	31	85	1,371
	-	-	14	23	37	370

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* Each value based on two replicate samples

TABLE G-6

Aerial fallout flux values (ng/m^2-day) for measurable DDT residues and 1254 PCB from surveys conducted in Los Angeles Basin during 1974.

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
SANTA MONICA						
4/23-4/30	120	59	50	43	272	674
4/30-5/8	342	102	111	62	617	541
5/8 -5/14	208	95	50	86	439	626
5/16-5/22	345	116	144	62	667	939
9/11-9/18	333	195	122	213	863	1,210
9/18-9/24	352	130	122	133	737	502
POINT VICENTE						
4/23-4/30	43	8	17	5	73	61
4/30-5/8	88	19	33	13	153	44
5/8 -5/14	18	9	17	8	52	33
5/16-5/22	40	19	31	16	106	98
9/11-9/18	77	33	50	24	184	72
9/18-9/24	105	70	36	84	295	7
CABRILLO						
4/23-4/30	138	50	86	29	303	300
4/30-5/8	247	64	194	43	548	507
5/8 -5/14	67	50	117	57	291	548
5/16-5/22	388	95	225	124	832	496
9/11-9/18	170	63	131	100	464	391
9/18-9/24	253	123	181	122	679	556
NEWPORT						
4/23-4/30	122	34	36	26	218	89
4/30-5/8	52	19	28	21	120	59
5/8 -5/14	35	22	36	26	119	67
5/10-5/22	32	11	22	11	76	39
9/11-9/18	58	33	28	32	151	130
9/18-9/24	227	75	47	51	400	139
ROLLING HILLS LANDFILL						
NORTH						
4/30-5/8	1,913	153	169	130	2,365	270
5/8 -5/14	398	166	153	92	809	481
5/16-5/22	930	208	217	92	1,447	112
9/11-9/18	1,088	261	256	113	1,718	398
9/18-9/24	37,635	6,217	2,050	613	46,515	1,620
EAST						
4/23-4/30	1,010	163	114	86	1,373	602
4/30-5/8	543	161	117	124	945	926

TABLE G-6 cont.

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
ROLLING HILLS LANDFILL						
EAST (Continued)						
5/8 -5/14	340	103	142	111	696	535
9/11-9/18	273	86	61	81	501	219
9/18-9/24	518	200	81	225	1,024	1,190
SOUTH						
4/23-4/30	8,750	1,394	694	113	10,951	494
4/30-5/8	6,947	1,208	489	165	8,809	128
5/8 -5/14	1,685	267	397	84	2,433	200
5/16-5/22	23,117	1,811	750	286	25,964	154
9/11-9/18	45,942	15,370	2,147	-	63,459	2,290
9/18-9/24	5,060	1,366	2,975	329	9,730	220
WEST						
4/23-4/30	568	102	94	71	835	148
5/8 -5/14	522	86	106	105	819	276
5/16-5/22	1,012	75	92	75	1,254	430
9/11-9/18	1,378	209	167	94	1,848	240
MONTROSE CHEMICAL CORP.						
NORTH						
9/11-9/18	4,493	1,202	492	214	6,401	946
9/18-9/24	13,655	2,738	1,039	519	17,951	1,340
NORTHEAST						
4/23-4/30	17,130	2,805	1,272	227	21,434	874
4/30-5/8	7,768	1,270	1,497	229	10,764	831
5/8 -5/14	4,488	766	725	124	6,103	1,010
5/16-5/22	5,097	714	758	216	6,785	1,280
9/11-9/18	5,595	1,677	942	84	8,298	1,480
9/18-9/24	4,648	786	431	314	6,179	1,230
SOUTHEAST						
4/23-4/30	8,590	1,264	867	132	10,853	1,100
4/30-5/8	25,462	414	2,425	419	28,720	1,080
5/8 -5/14	10,157	1,752	1,369	248	13,526	1,040
5/16-5/22	20,153	3,109	1,994	270	25,526	1,280
9/11-9/18	14,103	1,711	1,178	324	17,316	2,190
9/18-9/24	17,002	2,075	2,511	327	21,915	7,200
SOUTH						
9/11-9/18	10,947	2,608	2,189	200	15,944	1,220
9/18-9/24	3,348	989	889	341	5,567	1,620

TABLE G-6 cont.

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
MONTROSE CHEMICAL CO. (Contd.)						
SOUTHWEST						
4/23-4/30	5,347	927	475	197	6,946	485
4/30-5/8	1,488	311	261	171	2,231	233
5/16-5/22	7,137	1,039	747	202	9,125	954
9/11-9/18	4,463	1,009	327	221	6,020	815
9/18-9/24	2,222	517	450	252	3,441	209
NORTHWEST						
4/23-4/30	22,008	3,919	1,919	290	28,136	1,170
4/30-5/8	7,747	1,819	1,572	416	11,554	1,790
5/8 -5/14	4,708	1,195	1,461	283	7,647	2,210
5/16-5/22	8,138	1,675	3,697	510	14,020	1,170
9/11-9/18	6,600	1,836	15,247	173	23,856	1,890
9/18-9/24	5,068	1,701	767	654	8,190	1,530
LOS ANGELES COUNTY MUSEUM						
4/23-4/30	448	138	39	79	704	926
4/30-5/8	312	120	58	97	587	509
5/8 -5/14	460	105	83	49	697	302
5/16-5/22	290	70	117	33	510	306
9/11-9/18	380	141	78	136	735	917
9/18-9/27	442	209	106	156	913	728
PARAMOUNT						
4/23-4/30	662	114	69	30	875	361
4/30-5/8	2,107	541	553	181	3,382	1,478
5/8 -5/14	1,302	284	314	108	2,008	885
5/16-5/22	2,917	361	328	143	3,749	980
9/11-9/18	1,320	362	389	149	2,220	1,206
9/18-9/24	955	219	244	202	1,620	370
SOUTH SAN GABRIEL						
4/23-4/30	1,172	259	239	141	1,811	1,665
4/30-5/8	308	94	69	57	528	363
5/8 -5/14	513	245	128	70	956	639
5/16-5/22	277	67	36	38	418	352
9/11-9/18	272	102	58	81	513	493
9/18-9/24	448	198	169	324	1,139	750
WHITTIER						
4/23-4/30	700	189	167	202	1,258	498
4/30-5/8	1,258	350	339	329	2,276	1,513
5/8 -5/14	2,178	444	450	435	3,507	1,261
5/16-5/22	1,885	125	100	124	2,234	476
9/11-9/18	585	153	142	159	1,039	537
9/18-9/24	375	152	139	208	874	404

TABLE G-6 cont.

Sample Period	p,p'-DDT	o,p'-DDT	p,p'-DDE	p,p'-DDD	Total DDT	1254 PCB
KAZARIAN LANDFILL						
NORTH						
4/23-4/30	2,435	303	253	210	3,201	2,409
4/30-5/8	448	153	128	108	837	1,063
5/8 -5/14	663	219	261	175	1,318	2,019
5/16-5/22	612	191	144	186	1,133	1,941
9/11-9/18	482	136	161	198	977	811
9/18-9/24	485	186	189	162	1,022	1,265
EAST						
4/23-4/30	530	70	89	44	733	387
4/30-5/8	1,145	245	206	78	1,674	300
5/8 -5/14	702	189	167	129	1,187	369
5/16-5/22	692	116	211	90	1,109	257
9/11-9/18	435	161	194	173	963	715
9/18-9/24	572	123	100	135	930	452
SOUTH						
4/23-4/30	492	127	100	89	808	756
4/30-5/8	1,137	206	211	98	1,652	544
5/8 -5/14	482	180	239	83	984	763
5/16-5/22	663	111	92	70	936	428
9/11-9/18	472	123	117	129	841	407
9/18-9/24	498	217	142	217	1,074	554
WEST						
4/30-5/8	1,017	259	292	192	1,760	826
5/8 -5/14	1,440	294	258	157	2,149	967
5/16-5/22	505	133	108	116	862	548
9/11-9/18	245	114	103	130	592	752
9/18-9/24	523	297	172	329	1,321	1,169
PLACENTIA						
4/23-4/30	993	289	369	206	1,857	378
4/30-5/8	238	67	131	57	493	81
5/8 -5/14	938	275	622	240	2,075	483
5/16-5/22	2,175	302	433	173	3,083	513
9/11-9/18	458	197	472	271	1,398	598
9/18-9/24	3,490	878	1,236	871	6,475	1,591
SANTA ANA						
4/23-4/30	348	130	336	157	971	578
4/30-5/8	208	159	428	132	927	1,139
5/8 -5/22	112	38	53	67	270	270
9/11-9/18	532	159	158	87	936	1,239
9/18-9/24	1,303	334	158	544	2,339	983

APPENDIX H

OCEAN CURRENT ADVECTION

Table H-1 lists concentrations of identifiable DDT and PCB compounds measured in replicate surface seawater samples collected along the northwestern boundary of the Southern California Bight. Table H-2 compares results obtained for Los Angeles Harbor seawater using organic solvent extraction vs. concentraction on polyurethane foam columns. Analyses by B. de Lappe and R. Risebrough at Bodega Marine Laboratory (Univeristy of California, Berkeley). Equipment used to sample chlorinated hydrocarbons in seawater was developed with the support of the National Science Foundation International Decade of Ocean Exploration, (Grant Number ID072-06412 A02).

TABLE H-1

Concentrations (ng/l) of chlorinated hydrocarbons in surface seawater collected along the northwestern edge of the Bight, September 26-27, 1973*

Locality	p,p'-DDE	p,p'-DDT	1254 PCB
34°26'N	0.12	0.37	0.27
120°35'W	0.10	0.32	
34°18'N	0.09	0.35	0.36
120°35'W	0.07	0.27	
34°10'N	0.12	0.79	0.49
120°35'W	0.13	0.82	
34°02'N	0.10	0.51	0.46
120°35'W	0.13	0.75	
33°54'N	0.08	0.46	0.44
120°35'W	0.09	0.53	
33°34'N	0.13	1.3	0.49
120°35'W	0.08	0.79	
33°14'N	0.06	0.47	0.38
120°14'W	0.06	0.53	

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* Replicate samples analyzed for p,p'-DDE and p,p'-DDT; replicates combined for 1254 PCB analysis.

TABLE H-2

Intercalibration of Methodologies for
for extraction of chlorinated hydrocarbons from seawater.
Los Angeles Harbor, May, 1974.

(from B. de Lappe and R. Risebrough, BML, pers. comm.)

METHOD	N	VOLUME EXTRACTED LITERS	ng/l P,p'-DDE	P,p'-DDD	PCB
Blank	1	Assume 40	.02	0.017	.14
Solvent Extraction Hexane	2	16.1	1.9	1.0	1.5
Solvent Extraction Methylene Chloride	1	25.3	1.6	0.9	2.8
Foam Column Gravity	8	23-45	1.8	1.1	3.6
Foam Colum Vacuum	3	26-79	1.8	1.1	3.0

APPENDIX I

CHLORINATED HYDROCARBON DISPERSION MECHANISMS

Effluent Particulates

Several experiments have been conducted in an effort to learn more about the role wastewater particulates play in the dispersion of synthetic organics such as chlorinated hydrocarbons. Filtering tests made by the County Sanitation Districts of Los Angeles County in 1972 (CSDLAC, Feb. 1972) indicated that more than 95 percent of both the total DDT and the total PCB measured in JWPCP final effluent was associated with the particulate fraction ($>$0.8 μ). One of the more useful methods of characterizing the particulate content of an effluent (besides its gross concentration of total suspended solids, TSS) is through a settling velocity distribution; such distributions have been used in the past to model trace metal dispersion following submarine discharge (Hendricks and Young, 1974). A settling velocity distribution may be obtained using the pipet method described by Krumbein and Pettijohn (1938). Briefly, the effluent is well-mixed in a 1-liter cylinder, and samples are pipetted from a fixed depth over time and the suspended solids measured. The mass fraction of particulates with settling velocity less than a given value (Vs) is then obtained and plotted versus Vs.

In September 1973, we conducted an initial experiment at room temperature with a one-day composite of JWPCP final effluent (TSS concentration: 192 mg/l). The test extended over a six-day period, and the particulate concentration of each 40 ml subsample was determined by evaporation and weighing of the residue. The dissolved salt blank was assumed to be the final six-day residue (64 mg); this was subtracted to give the estimates of TSS obtained over the sampling period (Table I-1). The resultant Settling velocity distribution is illustrated by Curve A in Figure I-1. Another 40-ml aliquot was taken at each sampling for analysis of chlorinated hydrocarbons. The concentrations observed near the top of the settling cylinder over the six-day period are also listed in Table I-1.

The following year, we conducted similar experiments with the five most important municipal wastewaters being discharged to the Bight. Effluent composites from the JWPCP, Hyperion 5-mile and 7-mile, OCSD, and Point Loma systems were obtained and settled over eight-day periods at 12°C. In these experiments, 40-ml samples taken at 10 cm depth were filtered through tared glass fiber filters, which were dried overnight and then weighed to determine particulate concentration. (Previous tests had indicated no difference in results from 0.45 μ membrane or glass fiber filters). The resultant settling velocity distributions are plotted in Figure I-2. These results indicate that, with the exception of the Hyperion 7-mile sludge, approximately 50 percent of the particulate matter in these samples settled out with a velocity of less than 10^{-3} cm/sec.

At each sampling period, a second 40-ml aliquot was taken and the whole sample analyzed for chlorinated hydrocarbon content. The first sample from each collection was analyzed by gas chromatography to determine if measurements could be made on such a small sample. Only the JWPCP effluent had sufficiently high concentrations to yield meaningful data (Table I-2a). At the end of the 8-day settling period, three successive samples of resultant floatable material from the JWPCP effluent were taken by dipping filter paper pads onto the surface of the liquid. The three pads were combined for analysis and comparison with the initial sample concentration. Table I-2b presents the results for the JWPCP effluent.

We have also analyzed settling velocity data obtained by Myers (1974) on JWPCP effluent diluted 1:1 with filtered seawater. In Figure I-1, we compare his (dilution) settling velocity distribution (Curve C) with those from our first and second non-dilution distributions (Curves A and B). The most striking observation from this comparison is the remarkable agreement between distributions B and C. These independent results obtained at two different institutions for undiluted and diluted JWPCP effluent, respectively, suggest that the modest dilutions possible in laboratory experiments probably would not result in markedly different settling velocity distributions from those we have obtained for the undiluted five major effluents (Figure I-2). It also appears that our initial results (Curve A) may be biased toward low settling velocities. This might have been caused by the unusually low TTS concentration (192 mg/l) of sample A; samples B and C contained 315 and 280 mg/l, respectively, which are much more typical of JWPCP effluent.

The chlorinated hydrocarbon concentrations in JWPCP final effluent measured over time in the settling experiments (Tables I-1 and I-2a)suggest that these effluent contaminants settle fairly slowly. Comparison of average concentrations for the first hour with subsequent values indicates that approximately half of the initial total DDT and 1254 PCB had not settled beyond the 5-cm or 10-cm sampling level by the end of 1-2 days.

The data shown in Table I-2b suggest that floatable materials do not carry a significant fraction of the measurable DDT residues in the JWPCP final effluent to the air/liquid interface. Less than 1 percent of both the p,p'-DDE and the o,p'-DDE was found in the surface samples, despite the fact that the corresponding volumetric concentrations exceeded those in the subsurface sample by factors of 14 and 12, respectively.

Sediment Desorption

In view of the large reservoir of DDT wastes (approximately 200 tons) estimated to contaminate bottom sediments off Palos Verdes Peninsula (McDermott et al., 1974), experiments were conducted to examine the mobility and biological availability of this particulate-born contaminant.

In August 1974, several kilograms of bottom sediments from a depth of about 70 m were obtained with a Shipek grab sampler at two monitoring stations around the JWPCP submarine outfalls. The surface sediments at Station 2C were aerobic, while those at 7C were anaerobic; both were highly contaminated with DDT wastes (Figure I-3). Each sample was thoroughly mixed and then placed in one of the two glass tanks of a 75-liter aquarium which had been modified to allow seawater in two independent circulation systems to be slowly passed over each of the sediment surfaces (15 cm x 30 cm). The sediment depth was 20 cm, and 5 cm of unfiltered seawater was circulated over it at a velocity of about 1 cm/sec from a 10-liter reservoir. The seawater was changed every two weeks, and the entire system was maintained at 12°C, typical of bottom temperatures in the discharge region. Scoops of the upper 2 cm of sediment were taken from different areas of the surface at the zero, first, and second weeks, and every two weeks thereafter. Cores were taken during the first month, at the end of the second month, and every two months thereafter.

In addition, approximately 100 wet g of sediments 2C and 7C each were placed in 1-liter glass cylinders containing unfiltered seawater; these also were maintained at 12°C. The sediments were kept in an aerobic, highly-agitated state by means of an air stream immersed at the bottom of the cylinder. Every two weeks, the sediments were allowed to settle, the seawater was siphoned off, and a sediment sample was taken for analysis. New seawater was then replaced, as in the other disorption experiments. All samples were dried at 70°C for 12 hours and stored in glass until analyzed for chlorinated hydrocarbons and percent total volatile solids (TVS).

DDT compounds are the dominant known synthetic contaminant on the Palos Verdes shelf, and on the average, approximately 75 percent of this material in the upper 5 cm is p,p'-DDE (Figure I-4; Table I-3); this is also the major DDT residue found in the biota (Table I-6). Thus, with the exception of replicate time-zero scoops from tanks 2C and 7C (Table I-3) we have concentrated on quantifying the responses of this constituent as the major representative of chlorinated hydrocarbon contamination of the shelf. Samples collected at weeks twelve and twenty-six also were saponified and analyzed for 1242 and 1254 PCB (Table I-4).

Figures I-5 to I-10 illustrate our results. The aerobic 2C sediments initially contained approximately 40 ppm p,p'-DDE and

16 percent TVS, while the anaerobic 7C sediments initially contained approximately 75 ppm p,p'-DDE and 22 percent TVS. The data for the 2C sediments indicate a very slow loss rate for p,p'-DDE. Results illustrated for the surface sediment desorption experiment (Figure I-5) suggest an average decrease of only about 10 percent over a twenty-six week period. Although the core results (Figure I-6) evidence considerable variability, on the average, they agree with the surface data, indicating a constant concentration of about 40 ppm over this period. For the 7C sediments, the early surface scoop data (Figure I-7) suggest that the anaerobic sediments underwent an initial rapid loss of about one-third of their DDE content, with the average concentration decreasing from approximately 75 to 50 ppm during the first week of the experiment. However, the subsequent data are ambiquous, with replicate concentrations of 74 and 70 ppm being measured on week twenty-four. Similar variability was observed with the 7C core data (Figure I-8). Thus, it is possible that the apparent rapid loss rate for p,p'-DDE observed during the first week is partially a result of variability in the 7C aquarium sediments.

Figures I-9 and I-10 respectively illustrate the results observed for the agitated (and highly oxygenated) 2C and 7C sediments. Although the data again are quite variable, in general they are reasonable consistent with the previous results. The 2C sediments concentrations of p,p'-DDE decreased from about 50 ppm to about 40 ppm over the twenty-six week period, with the 7C sediments apparently decreased from about 75 ppm to about 50 ppm.

The PCB data in Table I-4 are also quite variable. However, on balance there is little evidence of significant desorbtion of 1242 PCB or 1254 PCB from the contaminated sediment during the twenty-six week exposure.

One of the most interesting observations is that variations in the concentration of p,p'-DDE observed in these experiments are not paralleled by corresponding variations in percent total volatile solids. TVS values were obtained on the same dried sediment samples analyzed for DDE, and replication for this measure of organic content was generally within 1-2 percent. No significant loss of TVS was observed from the 7C or 2C sediments over twenty-six weeks, indicating that this parameter represented a very refractory organic constituent of the bottom sediments in the discharge field.

Although these data suffer from the usual limitation of extrapolating laboratory results, they are consistent with other observations made on field samples. Table I-5 lists concentrations of total DDT and 1254 PCB measured in surface sediments taken during summer 1972 and summer 1975 from seventeen CSDLAC standard monitoring (benthic grid) stations in the JWPCP discharge zone off Palos Verdes Peninsula. Most of these stations were located at depths of about 35 m (100 ft) or 70 m (200 ft), and are fairly representative of the discharge zone from which benthic flatfish such as the Dover sole (Microstomus pacificus) are trawled.

Median 1972/1975 ratios for total DDT and 1254 PCB in these sediments were 1.5 and 1.6, respectively. (By comparison, corresponding median values for these contaminants measured in muscle tissue fillets of Dover sole trawled from this zone in May 1972 and February 1975 were 1.5 and 1.4, respectively). In view of the fact that the estimated "effective" input rates* of total DDT and total PCB between 1972 and 1975 decreased by respective factors of about 5.8 and 12.0, as in our laboratory experiments it appears that these chlorinated hydrocarbons are not easily desorbed or otherwise mobilized from the bottom sediments of the Palos Verdes shelf.

Uptake in Water Column

Tables I-6 to I-11 and Figures I-11 to I-12 present data on the biological availability of chlorinated hydrocarbon contaminants near the three largest submarine outfall systems in the Bight. Details of the experiments are presented in Section XII of Volume I.

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* DDT estimates obtained from CSDLAC data for the half-year prior to May 1972 and February 1975; PCB estimates obtained from best available data for the corresponding periods. See Table B-5.

Table I-1. Chlorinated hydrocarbon concentrations (μg/l) and total suspended solids (mg/l) in 40-ml samples taken during a six-day settling experiment with JWPCP final effluent. Collected September 17, 1973.

	Sample Depth (cm)	TSS	p,p'-DDE	p,p'-DDD	1254 PCB
0-min		192	2.50	3.41	2.79
1-min	10	188	2.29	2.40	2.70
4-min	10	178	1.70	0.80	1.21
16-min	10	160	1.81	2.10	2.10
32-min	5	155	2.60	2.50	1.91
4-hr	5	155	1.70	1.60	1.30
16-hr	5	70	1.00	1.10	1.10
6-day	5		0.26	0.35	0.70

TABLE I-2a

Chlorinated hydrocarbon concentrations (µg/1) and total suspended solids (mg/1) in 40-ml samples taken at 10 cm depth during a seven-day settling experiment with JWPCP final effluent. Collected August 22-23, 1974.

Time	TSS	p,p'-DDT	o,p'-DDT	p,p'-DDE	o,p'-DDE	p,p'-DDD	o,p'-DDD	Total DDT	1254 PCB
0-min	315	0.12	0.09	6.01	1.51	1.29	0.16	9.18	0.79
1-min	305	0.05	0.02	6.01	1.98	1.08	0.10	9.24	0.83
4-min	252	0.07	0.04	6.04	1.35	1.31	0.11	8.92	0.81
16-min	262	0.12	0.06	6.29	2.22	1.39	0.17	10.2	2.17
1-hr	230	0.04	-	6.36	1.36	1.42	0.13	9.31	2.25
4-hr	135	0.16	0.10	3.62	0.93	0.97	0.04	5.82	1.77
8-hr	90	0.05	0.01	1.54	0.60	0.33	-	2.53	0.39
1-day	68	0.01	0.02	2.08	0.63	0.55	-	3.29	0.35
2-day	48	0.08	0.03	3.34	0.95	0.82	-	5.22	0.51
4-day	62	-	-	1.11	0.22	0.20	-	1.53	0.61
7-day	28	0.10	0.03	1.01	0.24	0.35	-	1.72	0.49

TABLE I-2b

Chlorinated hydrocarbons measured in three successive surface layer (filter) samples and in a 40-ml subsurface sample of the remixed 1-ℓ JWPCP final effluent composit (collected August 22-23, 1974) after a seven-day settling period.

Compound	ng on Filter Pads			Mixed Column	1st
	1st	2nd	3rd	(ng/1)	Mixed (%)
p,p'-DDT	-	-	-	320	-
p,p'-DDE	113	18	16	14,500	0.8
o,p'-DDE	24	-	-	3,600	0.7
p,p'-DDD	-	-	-	3,400	-

TABLE I-3
Chlorinated hydrocarbon concentrations (mg/dry kg) in replicate samples of aerobic (2c) and anaerobic (7c) sediments scooped at time-zero from the upper 2 cm of the desorption aquaria.

Compound	Sediment 2c		Sediment 7c	
	R-1	R-2	R-1	R-2
p,p'-DDT	0.3	0.4	0.8	0.2
o,p'-DDT	0.2	0.6	0.1	0.1
p,p'-DDE	43.6	37.5	78.3	73.7
o,p'-DDE	6.5	5.6	9.6	13.3
p,p'-DDD	4.0	3.0	11.4	13.9
o,p'-DDD	1.2	0.6	0.8	0.1
Total DDT	56	48	101	103
1242 PCB	<0.9	<1.0	<3.7	<5.0
1254 PCB	2.9	2.2	5.9	6.5
Total PCB	<3.8	<3.2	<9.6	<11.5

TABLE I-4.

Concentrations of 1242 PCB and 1254 PCB (mg/dry kg) in saponified samples of concentrated ocean bottom sediments after various periods in laboratory desorption aquaria.

	PCB 1242					
Weeks Immersed	Settled Aquaria				Agitated Aquaria	
	Station 2C		Station 7C		Sta. 2C	Sta. 7C
	R-1	R-2	R-1	R-2		
0*	<0.9	<1.0	<3.7	<5.0	-	<5.3
12	0.66	0.79	2.9	2.9	4.0	1.1
26	0.77	0.73	4.4	2.1	0.6	0.9
	PCB 1254					
0*	2.9	2.2	5.9	6.5	-	7.5
12	3.5	3.6	7.6	7.0	11.9	7.4
26	3.7	3.2	9.4	5.9	4.5	7.3

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* These samples were not saponified

TABLE I-5. Chlorinated hydrocarbon concentrations (mg/dry kg) in surface sediments collected during summer 1972 and summer 1975 from the JWPCP discharge zone off Palos Verdes Peninsula. **

CSDLAC Station	Total DDT 1972	Total DDT 1975	Total DDT 72/75 Ratio	1254 PCB 1972	1254 PCB 1975	1254 PCB 72/75 Ratio	1242 PCB 1975
1B	10.5	12.3	0.85	-	0.71	-	0.18
1C	31.8	45.6	0.70	1.44	2.74	0.52	0.69
3B*	18.9	12.4	1.52	1.37	0.81	1.69	0.18
3C	96.4	74.8	1.29	2.09	1.11	1.88	0.16
4B*	79.4	101	0.79	6.34	4.59	1.38	1.41
4C*	87.0	63.3	1.37	4.74	4.59	1.03	0.92
5B*	140	129	1.08	11.3	7.42	1.51	2.81
5C	77.5	76.2	1.02	7.39	5.46	1.35	2.12
6B	233	65.7	3.55	7.39	4.12	1.79	2.20
6C*	163	87.9	1.85	5.18	8.50	0.61	4.44
7B*	204	133	1.53	9.54	5.54	1.72	3.86
7C*	170	69.6	2.44	8.44	7.11	1.19	2.58
8B	176	45.6	3.86	11.7	2.44	4.80	1.09
8C*	176	66.8	2.63	11.7	3.99	2.93	2.15
9B	88.7	124	0.72	6.17	6.89	0.90	1.95
9C	133	28.7	4.63	16.0	0.94	17.02	0.19
10C	26.1	6.06	4.31	1.90	0.45	4.22	0.08

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* 1972 station designations (Figure I-3): 3B (18B); 4B ($\bar{x}$ of 3B, 5B); 4C ($\bar{x}$ of 3C, 5C); 5B (19B); 6C (21B); 7B ($\bar{x}$ of 6B, 8B); 7C ($\bar{x}$ of 6C, 8C); 8B (20B), 8C (20B)

** 1972 values for 1242 PCB unavailable because of sulphur and grease interferences for unsaponified samples; 1975 PCB values obtained after saponification and mercury treatment of extract.

TABLE I-6

Average chlorinated hydrocarbon concentrations (mg/dry kg) ± standard errors, for six male and six female soft tissue composite of the mussel, *Mytilus californianus*, collected in June 1974 from the intertidal zone at Point Sal and Royal Palm State Beach, California. Each composite consisted of five mussels, 4-6 cm in length.

	Control Region Point Sal, 25 June		Outfall Region Royal Palms, 26 June	
Compound	Male	Female	Male	Female
p,p'-DDT	0.008±0.0005	0.007±0.0006	0.04±0.005	0.06±0.005
o,p'-DDT	0.004±0.0001	0.004±0.0005	0.03±0.003	0.04±0.004
p,p'-DDE	0.077±0.003	0.067±0.003	3.5 ±0.64	5.4 ±0.28
o,p'-DDE	0.015±0.001	0.026±0.007	0.41±0.06	0.73±0.05
p,p'-DDD	0.009±0.0006	0.008±0.0004	0.11±0.01	0.18±0.007
o,p'-DDD	-	-	-	-
Total DDT	0.11 ±0.004	0.11 ±0.007	4.1 ±0.70	6.4 ±0.32
1242 PCB	0.016±0.003	0.019±0.001	0.12±0.01	0.19±0.01
1254 PCB	0.028±0.004	0.035±0.003	0.53±0.06	0.76±0.04
Total PCB	0.044±0.006	0.054±0.002	0.64±0.06	0.94±0.04

TABLE I-7

Chlorinated hydrocarbon concentrations (mg/dry kg) for soft tissue composites of five mussels, *Mytilus californianus* (4-6 cm), collected in January 1976 from four intertidal zones.

Compound	Control Region		Outfall Region					
	Point Sal		Santa Monica		Royal Palms		Newport	
	16 January		17 January		16 January		16 January	
	R_1	R_2	R_1	R_2	R_1	R_2	R_1	R_2
p,p'-DDT	0.004	0.003	0.023	0.029	0.030	0.016	0.012	0.028
o,p'-DDT	0.002	0.001	0.023	0.039	0.039	0.041	0.015	0.017
p,p'-DDE	0.113	0.098	0.606	0.776	3.50	3.08	0.419	0.553
o,p'-DDE	0.012	0.013	0.168	0.226	0.229	0.305	0.046	0.077
p,p'-DDD	0.002	0.004	0.037	0.069	0.055	0.101	0.013	0.017
o,p'-DDD	0.002	-	0.013	0.014	<0.001	0.009	0.003	0.001
Total DDT	0.135	0.119	0.870	1.15	3.85	3.55	0.508	0.693
1242 PCB	0.041	0.035	0.099	0.169	0.140	0.116	0.064	0.048
1254 PCB	0.033	0.017	0.299	0.372	0.456	0.362	0.206	0.185
Total PCB	0.074	0.052	0.398	0.541	0.596	0.478	0.270	0.233

TABLE I-8

Mean concentrations (mg/dry kg) ± 95% C.L. of chlorinated hydrocarbons in 6 samples of whole soft tissue of mussels (*M. californianus*) collected between October 9, 1974 and January 6, 1975 from 5 depths of the taut-line buoy system moored off the JWPCP outfalls. Mussels translocated from Point Sal June 25, 1974. Weeks 11-28.

Constituent	Surface 0.5 m	4 m	15 m	25 m	Bottom 30 m
p,p'-DDT	0.013 ±0.007	0.014 ±0.010	0.038 ±0.031	0.051 ±0.058	0.048 ±0.075
o,p'-DDT	0.009 ±0.004	0.010 ±0.005	0.018 ±0.010	0.029 ±0.016	0.035 ±0.022
p,p'-DDE	1.543 ±0.569	3.148 ±2.263	4.880 ±1.618	7.429 ±1.186	11.025 ±3.958
o,p'-DDE	0.217 ±0.055	0.420 ±0.243	0.760 ±0.233	1.004 ±0.185	1.668 ±0.722
p,p'-DDD	0.080 ±0.016	0.145 ±0.056	0.287 ±0.078	0.368 ±0.125	0.567 ±0.259
o,p'-DDD	0.034 ±0.015	0.058 ±0.044	0.079 ±0.054	0.102 ±0.044	0.175 ±0.161
Total DDT	1.9 ±0.65	3.8 ±2.6	6.0 ±1.9	8.9 ±1.4	13.3 ±5.0
1242 PCB	0.097 ±0.035	0.177 ±0.051	0.370 ±0.137	0.605 ±0.293	0.818 ±0.340
1254 PCB	0.204 ±0.052	0.328 ±0.164	0.558 ±0.141	0.808 ±0.140	1.143 ±0.508
Total PCB	0.30 ±0.07	0.50 ±0.19	0.93 ±0.18	1.4 ±0.40	2.0 ±0.68

TABLE I-9

Mean concentrations (mg/dry kg) ± 95% C.L. of chlorinated hydrocarbons in 4 samples of whole soft tissue of mussels (*M. californianus*) collected between March 11 and April 22, 1976 from 4 depths of the taut-line buoy system moored off the JWPCP outfalls. Mussels were translocated from Point Sal January 28, 1976. Weeks 6-12.

Constituent	Surface 0.5 m*	10 m	15 m	20 m	Bottom 30 m
p,p'-DDT	-	0.039	0.053	0.029	0.036
	-	±0.017	±0.044	±0.019	±0.024
o,p'-DDT	-	0.022	0.028	0.018	0.023
	-	±0.012	±0.010	±0.007	±0.019
p,p'-DDE	-	2.882	4.261	2.772	4.830
	-	±1.224	±1.253	±1.014	±1.502
o,p'-DDE	-	0.405	0.545	0.417	0.868
	-	±0.169	±0.187	±0.188	±0.268
p,p'-DDD	-	0.241	0.309	0.200	0.474
	-	±0.119	±0.141	±0.138	±0.087
o,p'-DDD	-	0.062	0.069	0.046	0.118
	-	±0.046	±0.063	±0.039	±0.057
Total DDT	-	3.7	5.3	3.5	6.3
	-	±1.6	±1.6	±1.3	±1.9
1242 PCB	-	0.369	0.486	0.361	0.618
	-	±0.136	±0.189	±0.174	±0.163
1254 PCB	-	0.302	0.444	0.302	0.458
	-	±0.115	±0.224	±0.162	±0.229
Total PCB	-	0.67	0.93	0.66	1.1
	-	±0.25	±0.40	±0.33	±0.39

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* Surface culture bags lost

TABLE I-10

Mean concentrations (mg/dry kg) ± 95% C.L. of chlorinated hydrocarbons in 3 samples of whole soft tissue of mussels (*M. californianus*) collected between February 26 and April 16, 1976 from 5 depths of the taut-line buoy system moored off the Orange County Sanitation District outfall. Mussels were translocated from Point Sal January 14, 1976. Weeks 6-13.

Constituent	Surface 0.5 m	15 m	30 m	45 m	Bottom 60 m
p,p'-DDT	0.008 ±0.012	0.009 ±0.012	0.006 -	0.004 ±0.014	0.002 -
o,p'-DDT	0.006 ±0.004	0.006 ±0.004	0.004 -	0.003 ±0.005	0.002 -
p,p'-DDE	0.273 ±0.284	0.381 ±0.246	0.273 ±0.160	0.078 ±0.331	0.108 ±0.231
o,p'-DDE	0.042 ±0.057	0.047 ±0.042	0.048 ±0.050	0.019 ±0.074	0.017 ±0.039
p,p'-DDD	0.012 ±0.030	0.016 ±0.016	0.010 ±0.005	0.013 -	- -
o,p'-DDD	- -	0.001 -	- -	- -	- -
Total DDT	0.34 ±0.38	0.46 ±0.24	0.33 ±0.18	0.11 ±0.44	0.13 ±0.55
1242 PCB	0.060 ±0.074	0.090 ±0.076	0.401 ±0.642	0.236 ±0.197	0.130 ±0.443
1254 PCB	0.074 ±0.051	0.094 ±0.034	0.206 ±0.302	0.072 ±0.298	0.098 ±0.283
Total PCB	0.13 ±0.11	0.18 ±0.05	0.61 ±0.91	0.29 ±1.3	0.23 ±0.72

TABLE I-11

Mean concentrations (mg/dry kg) ± 95% C.L. of chlorinated hydrocarbons in 4 samples of whole soft tissue of mussels (*M. californianus*) collected between February 25 and March 25, 1976 from 5 depths of the taut-line buoy system moored off the Hyperion 7-mile outfall. Mussels were translocated from Point Sal January 28, 1976. Weeks 4-8.

Constituent	Surface 0.5 m	15 m	45 m	75 m	Bottom 90 m
p,p'-DDT	0.013 ±0.001	0.010 ±0.011	0.007 ±0.003	0.007 -	0.004 -
o,p'-DDT	0.008 ±0.002	0.008 ±0.003	0.007 ±0.003	0.006 -	0.006 -
p,p'-DDE	0.282 ±0.153	0.378 ±0.249	0.480 ±0.116	0.382 ±0.133	0.364 ±0.054
o,p'-DDE	0.041 ±0.006	0.035 ±0.024	0.061 ±0.014	0.060 ±0.024	0.058 ±0.009
p,p'-DDD	0.014 ±0.006	0.014 ±0.018	0.018 ±0.008	0.016 ±0.009	0.017 ±0.013
o,p'-DDD	0.004 ±0.008	0.005 ±0.011	0.004 ±0.002	0.005 ±0.009	0.004 ±0.008
Total DDT	0.36 ±0.14	0.45 ±0.31	0.58 ±0.12	0.46 ±0.16	0.44 ±0.07
1242 PCB	0.060 ±0.029	0.043 ±0.023	0.061 ±0.013	0.112 ±0.022	0.108 ±0.030
1254 PCB	0.094 ±0.017	0.110 ±0.071	0.274 ±0.118	0.382 ±0.038	0.336 ±0.121
Total PCB	0.15 ±0.04	0.15 ±0.09	0.31 +0.04	0.49 ±0.06	0.44 ±0.14

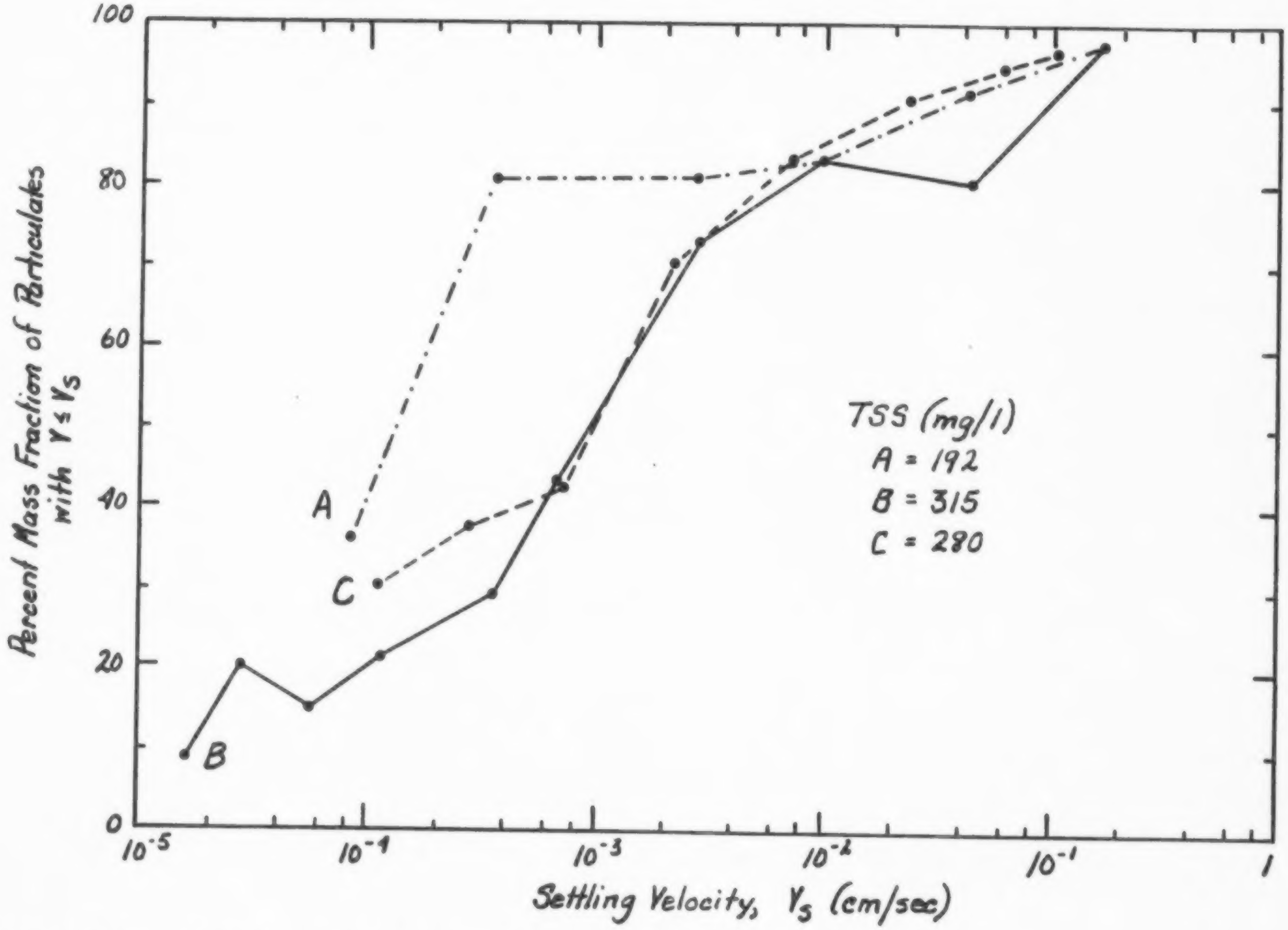


Figure I-1. Settling velocity distributions for JWPCP final effluent particulates. Curves A and B are for undiluted 24-hr composites collected 9/17-18/73 and 8/22-23/74, respectively. Curve C is for a 1:1 dilution with filtered seawater (0.2 μ) of a 24-hr composite sample collected 2/1-2/73 (from Myers, 1974).

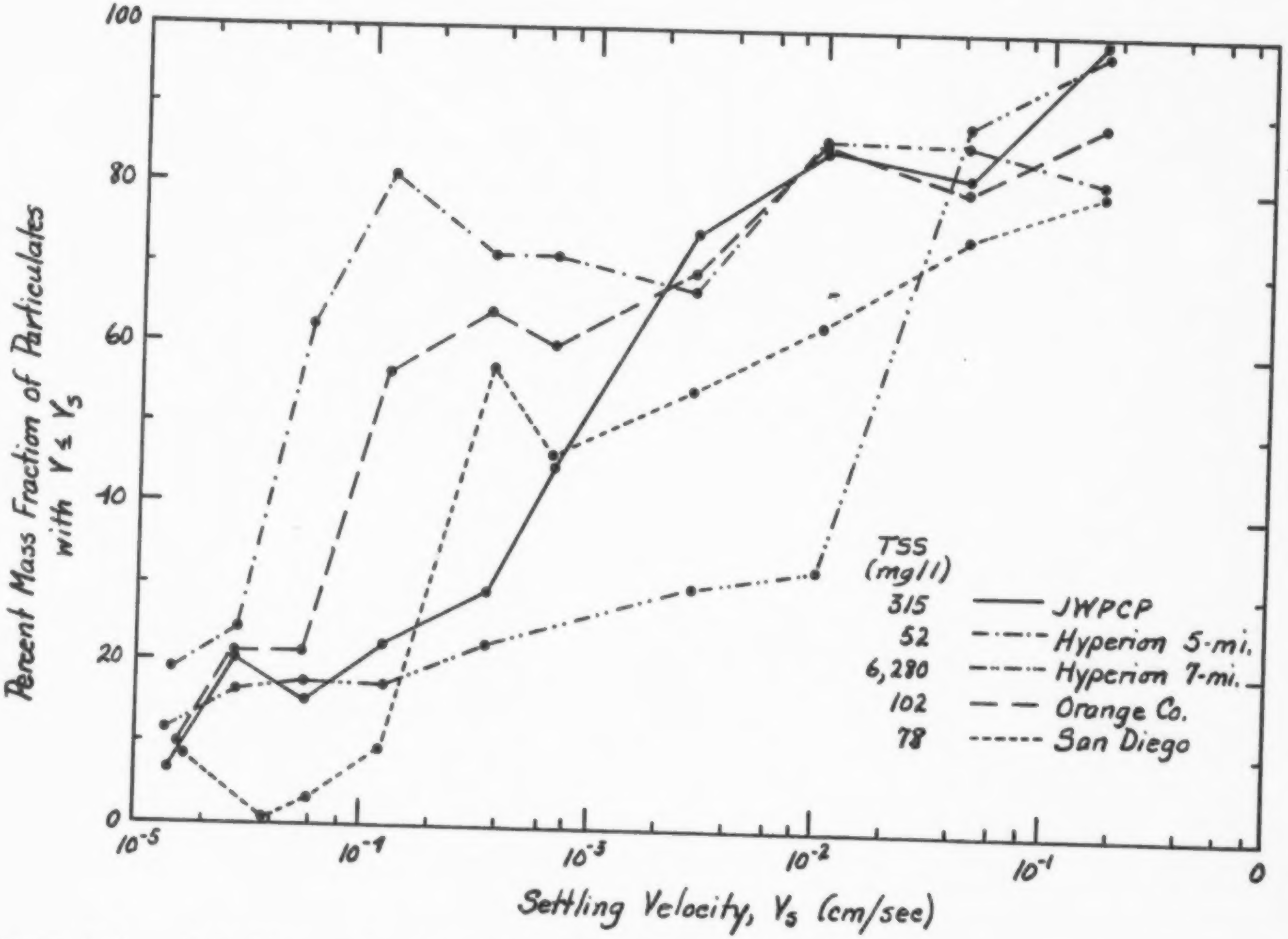


Figure I-2. Settling velocity distributions (T=12°C) for undiluted final effluents from five major southern California municipal wastewaters collected during Summer 1974.

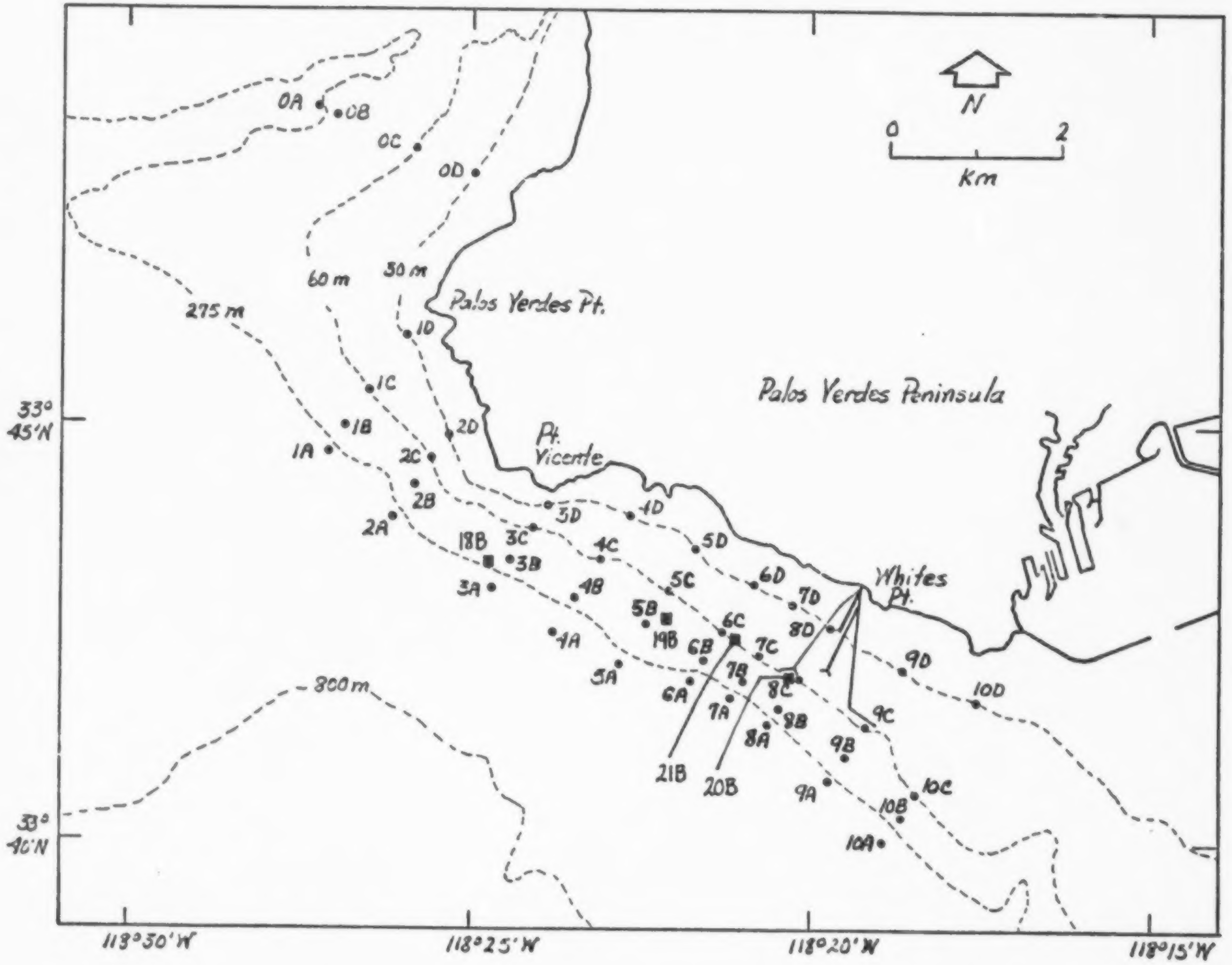


Figure I-3. Bottom sediment sampling grid in JWPCP discharge zone. The 1974 and 1976 mussel buoys were located at stations 4D and 9D, respectively. Total DDT concentrations in surface sediments collected from some of these stations during 1972 and 1975 are listed in Table I-5.

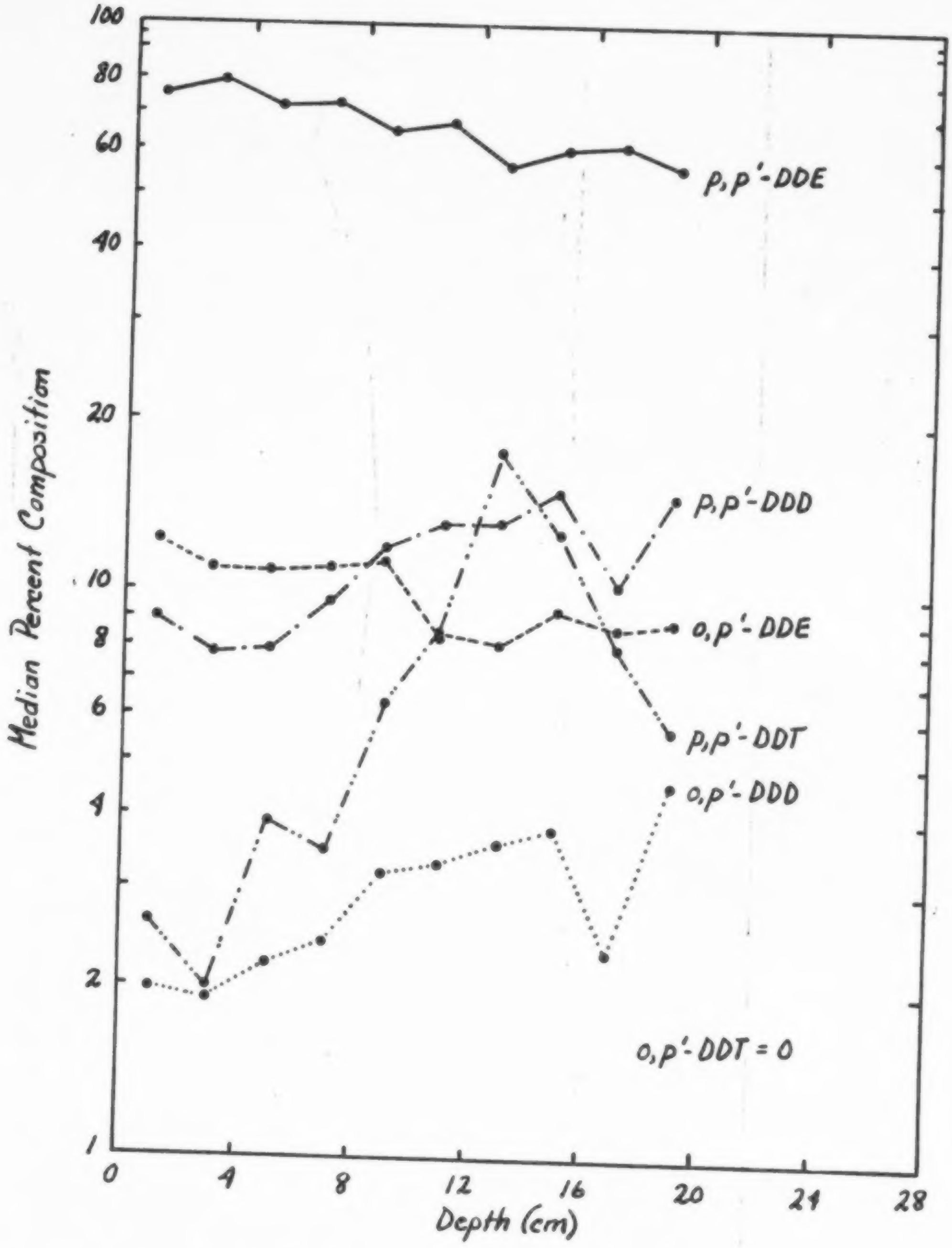


Figure I-4. Median percent contribution of each DDT isomer to the "total DDT" value at each depth, short gravity cores, June 1972. From McDermott et al., 1974.

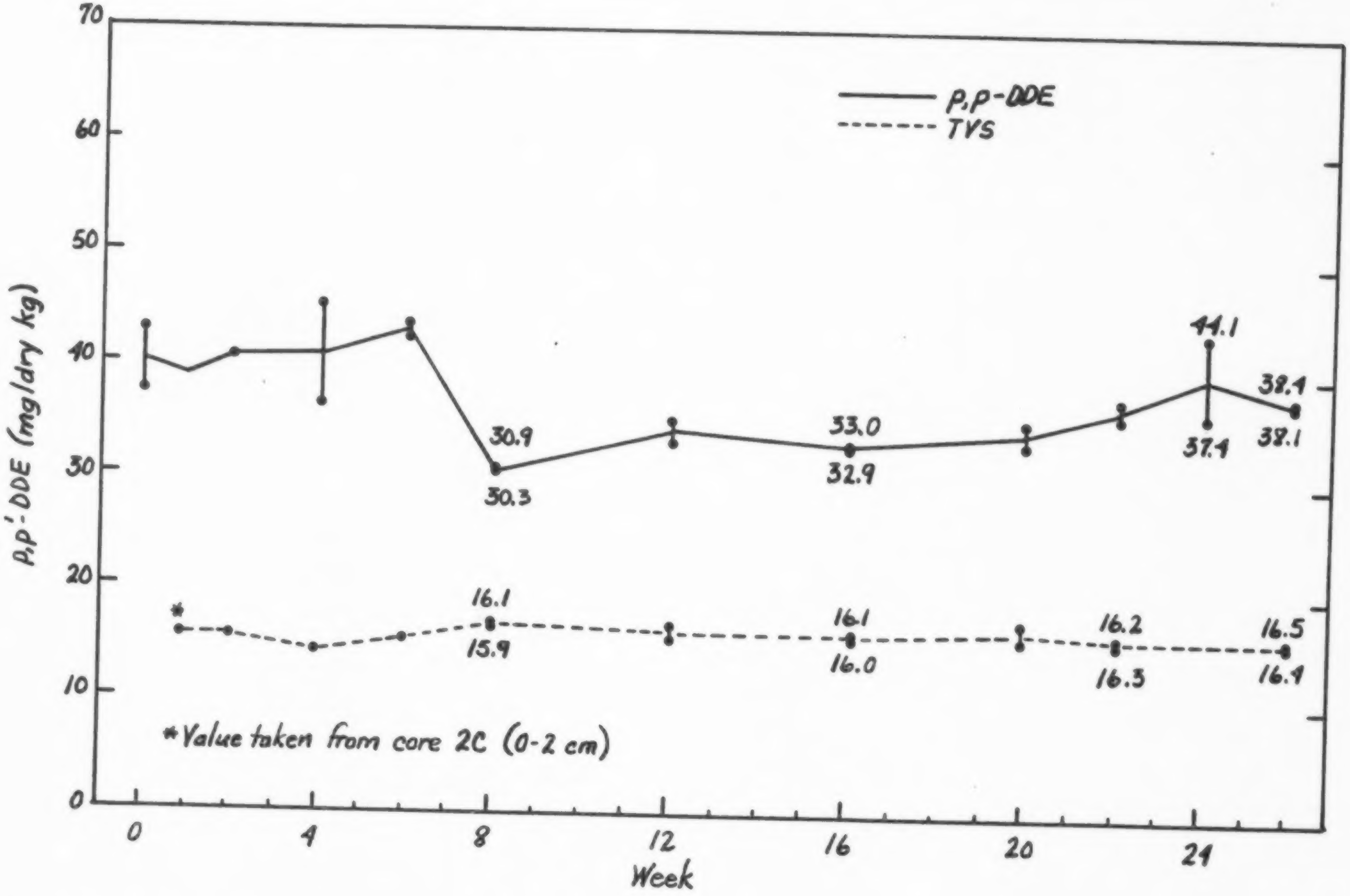


Figure I-5. Concentrations of p,p'-DDE and TVS in surface scoops of aerobic station 2C sediments measured during acquarium desorption test (T=12°C). Vertical bars or values indicate results for replicate samples.

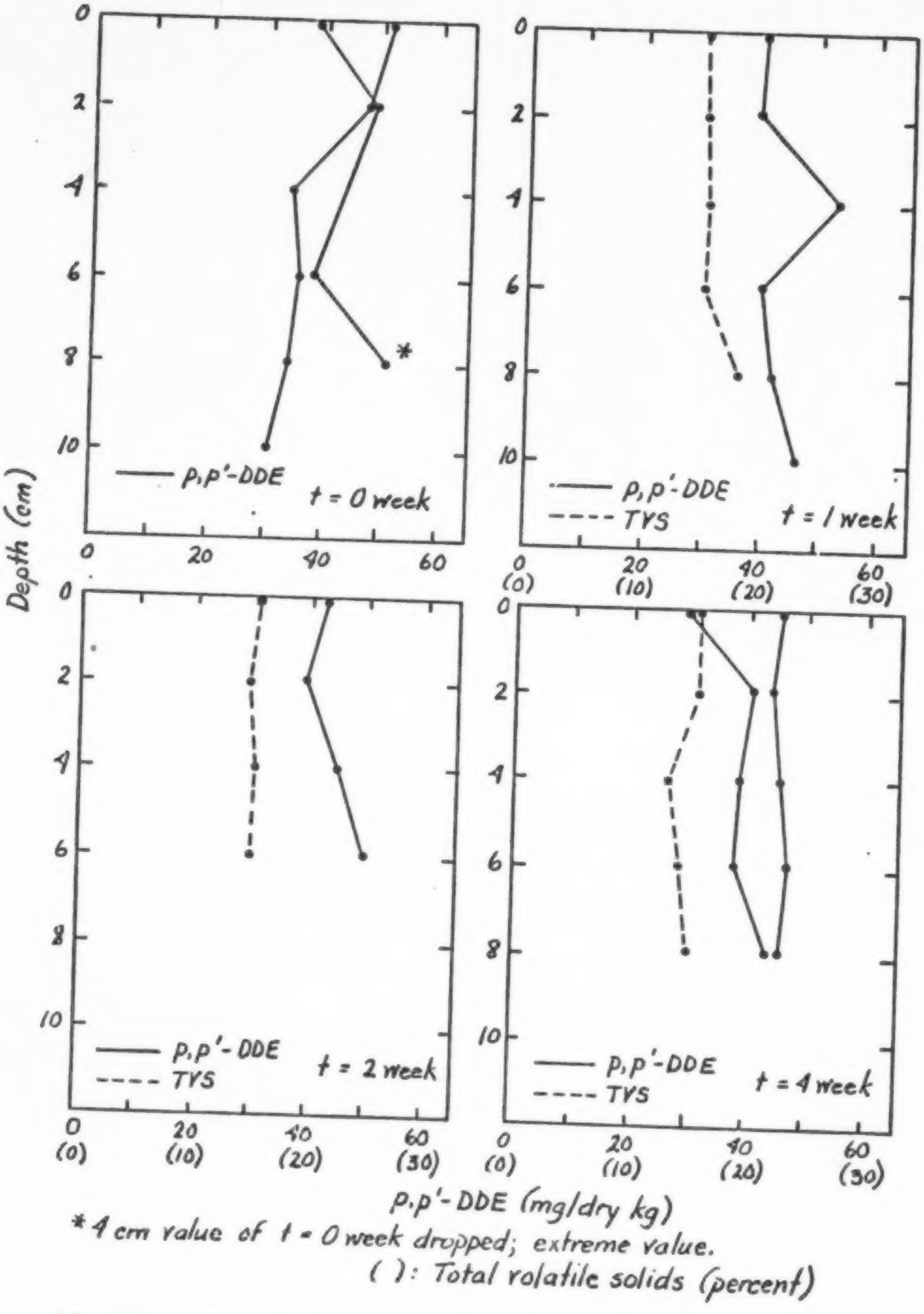


Figure I-6. Concentrations of p,p'-DDE and TVS in cores of aerobic Station 2C sediments during acquarium desorption test (T=12°c). Replicate cores analyzed for t-0 and t-4 weeks.

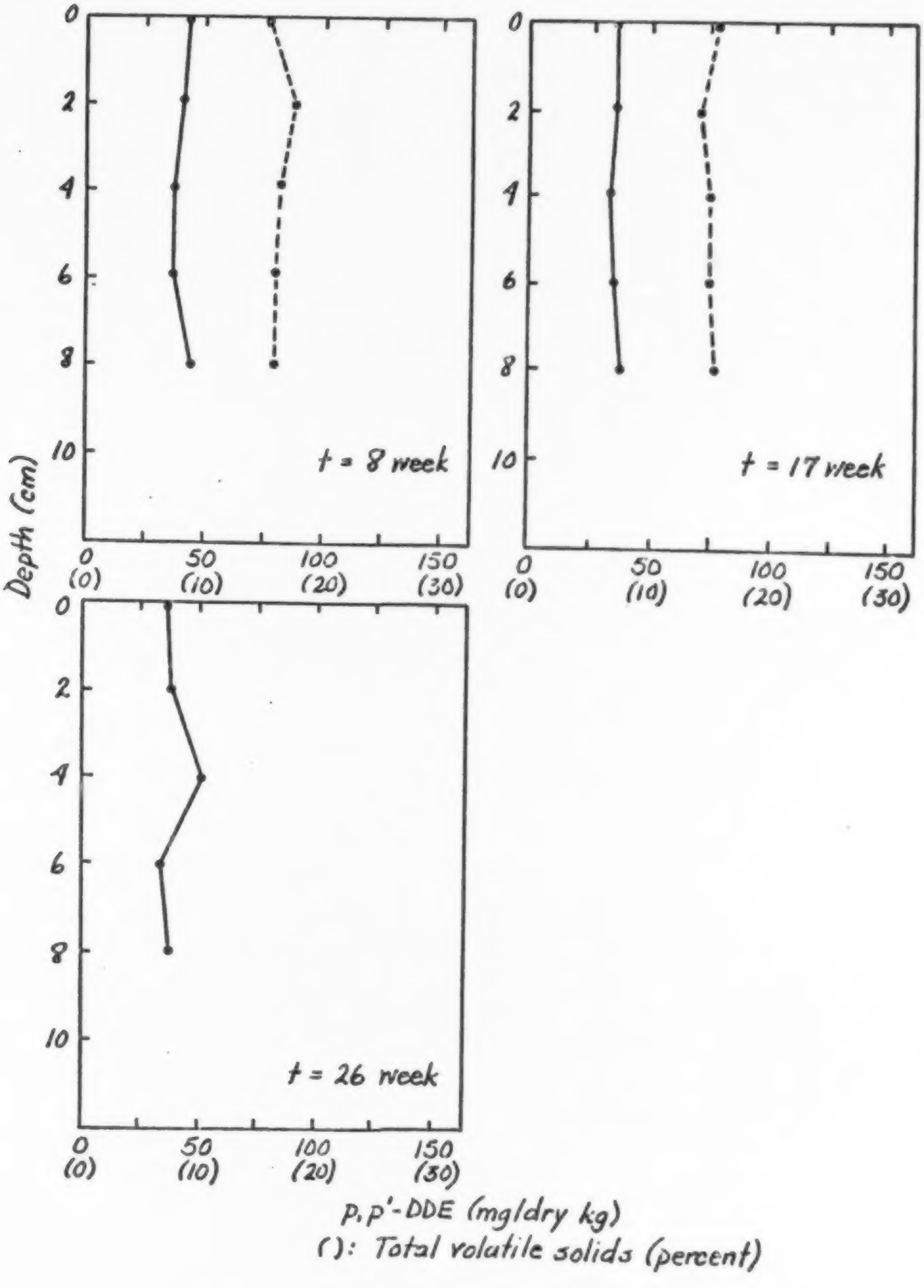


Figure I-6 cont.

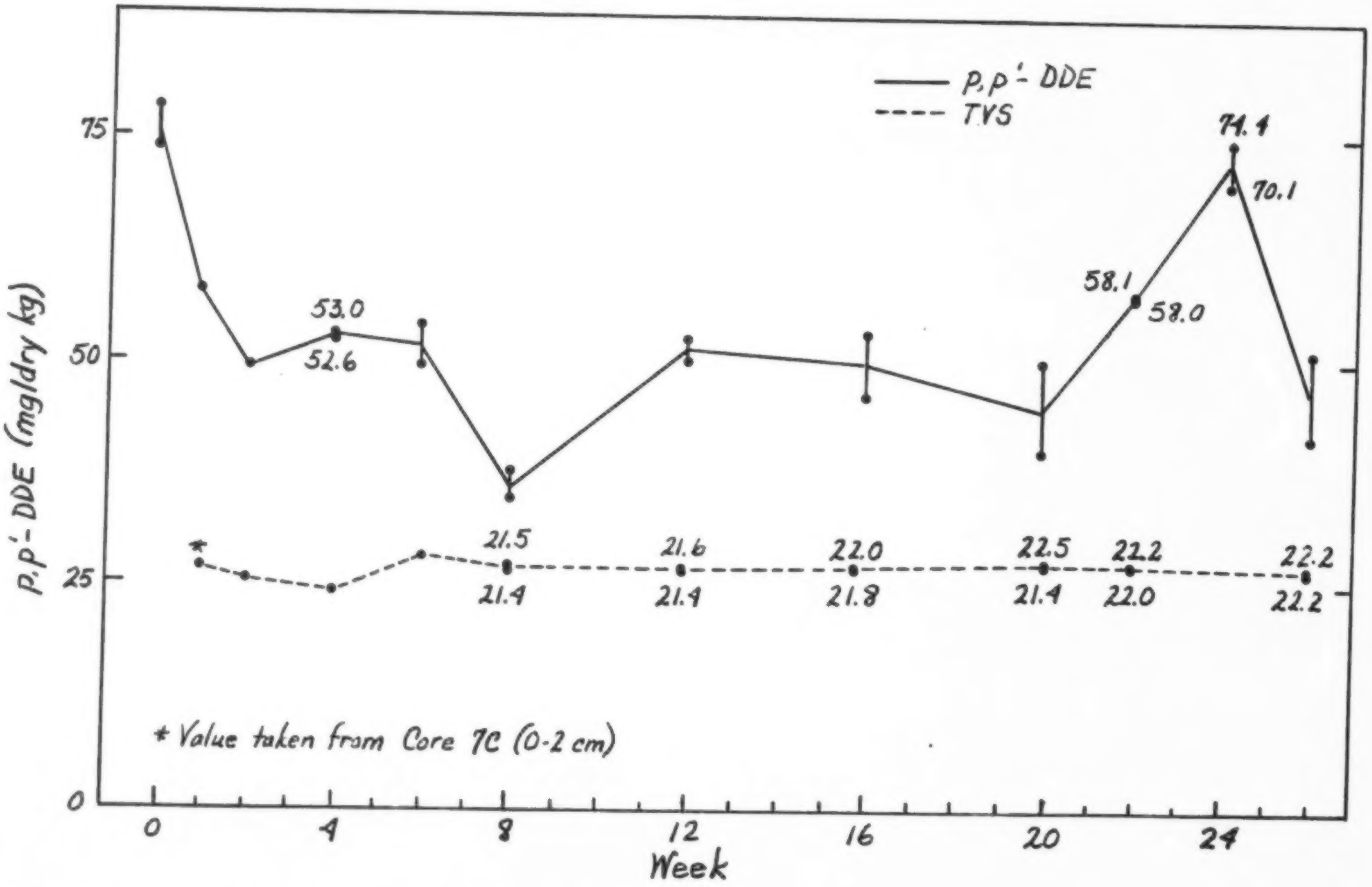
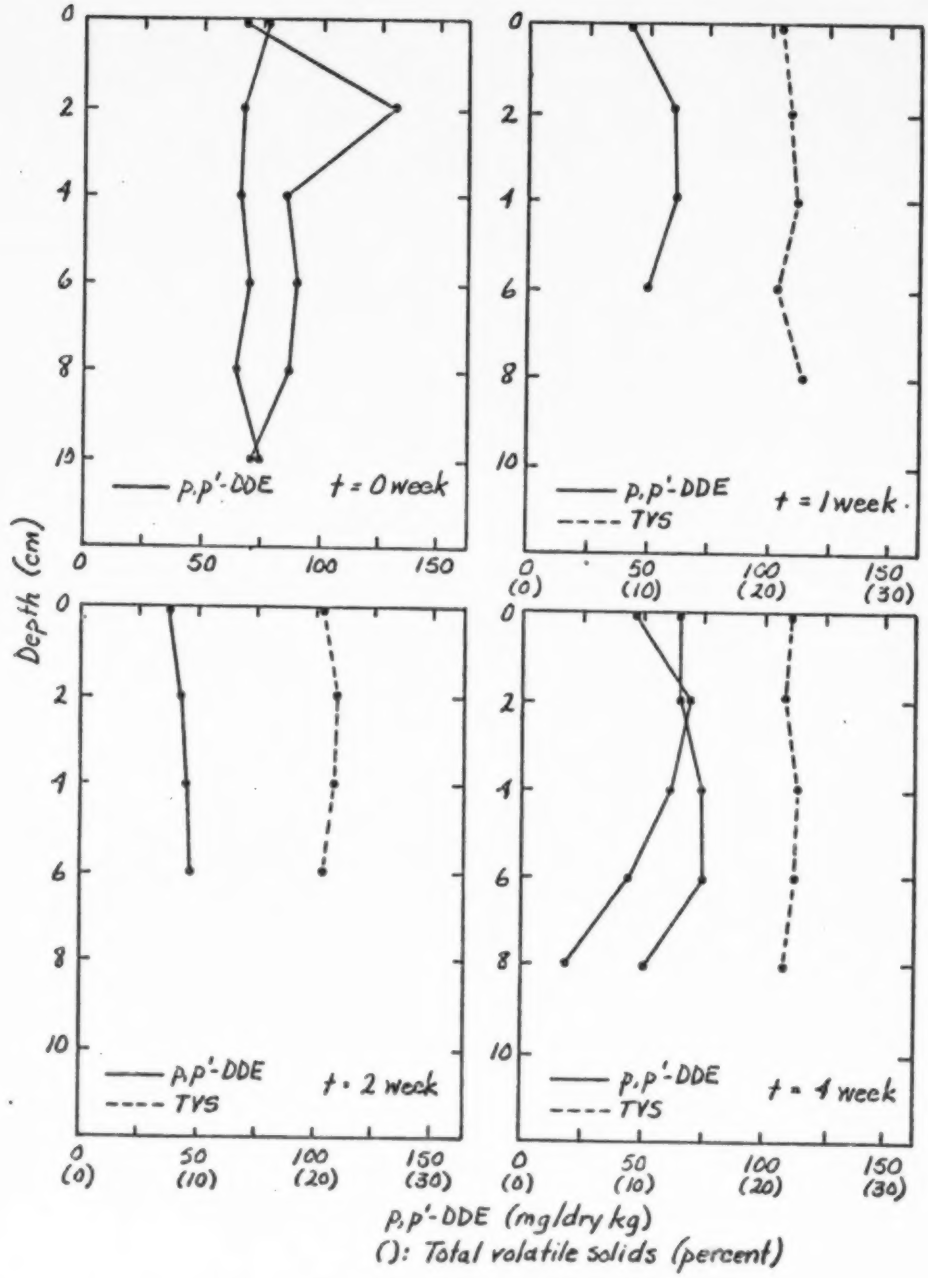


Figure I-7. Concentrations of p,p'-DDE and TVS in surface scoops of anaerobic station 7C sediments measured during acquarium desorption tests (T=12°C). Vertical bars or values indicate results for replicate samples.



Firgure I-8. Concentrations of p,p'-DDE and TVS in cores of anaerobic Station 7C sediments during acquarium desorption test (T=12°C). Replicate cores analyzed for t-0 and t-4 weeks.

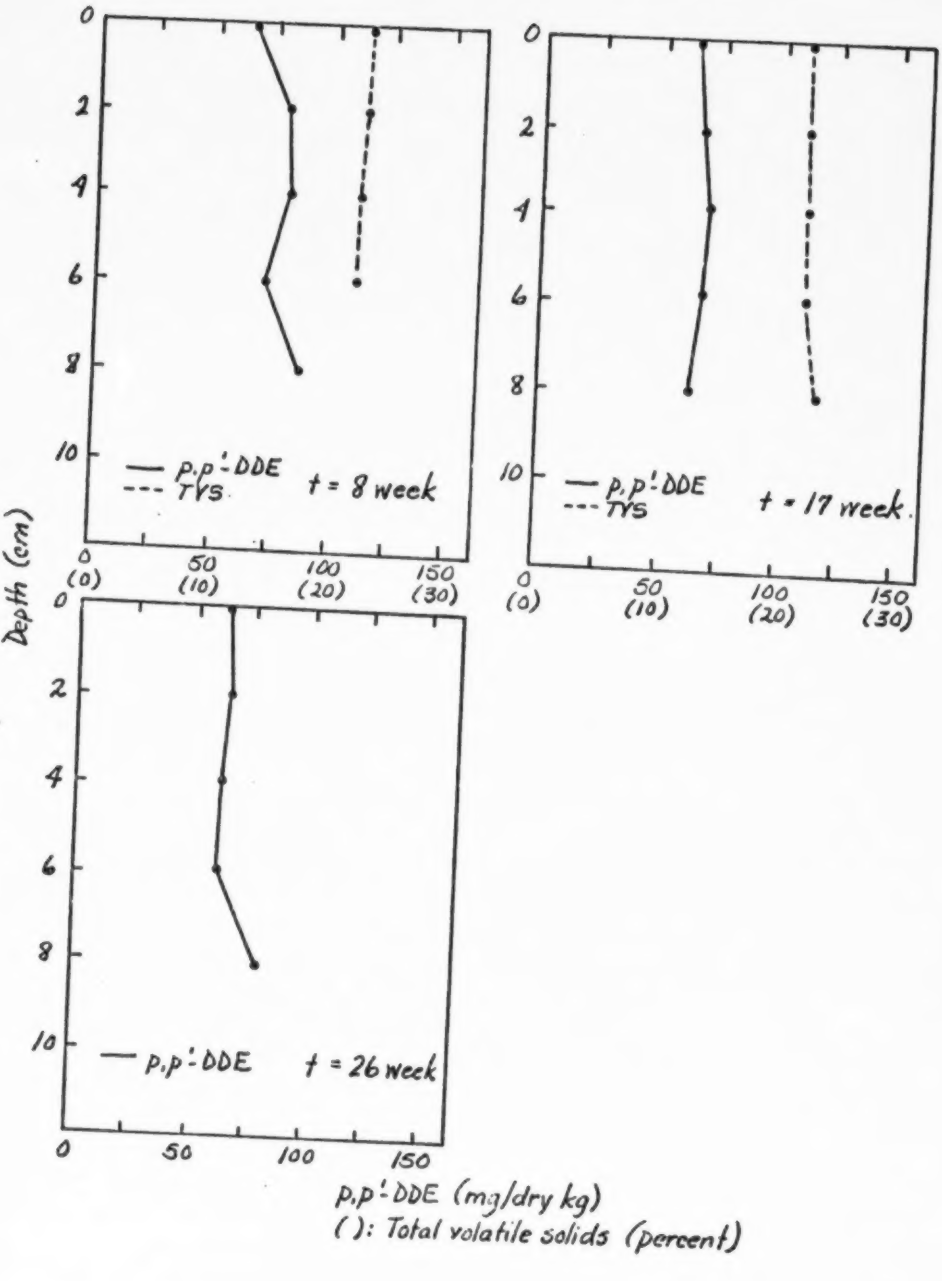


Figure I-8 cont.

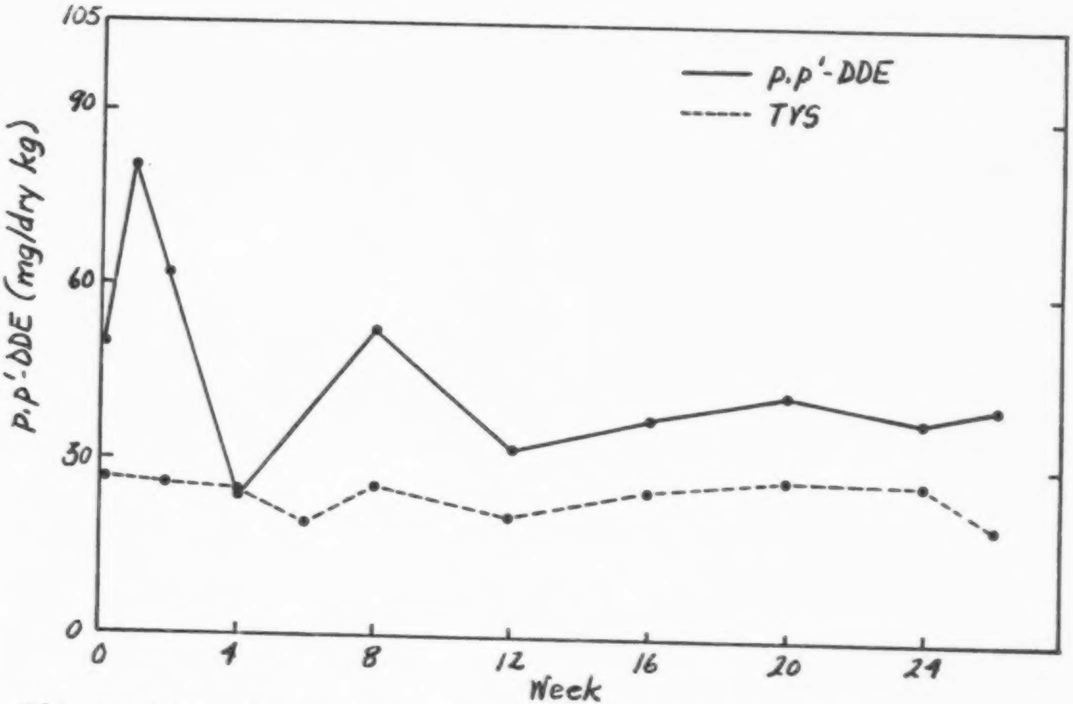


Figure I-9. Concentrations of p,p'-DDE and TVS in aerobic station 2C sediments measured during aerobic agitation desportion test.

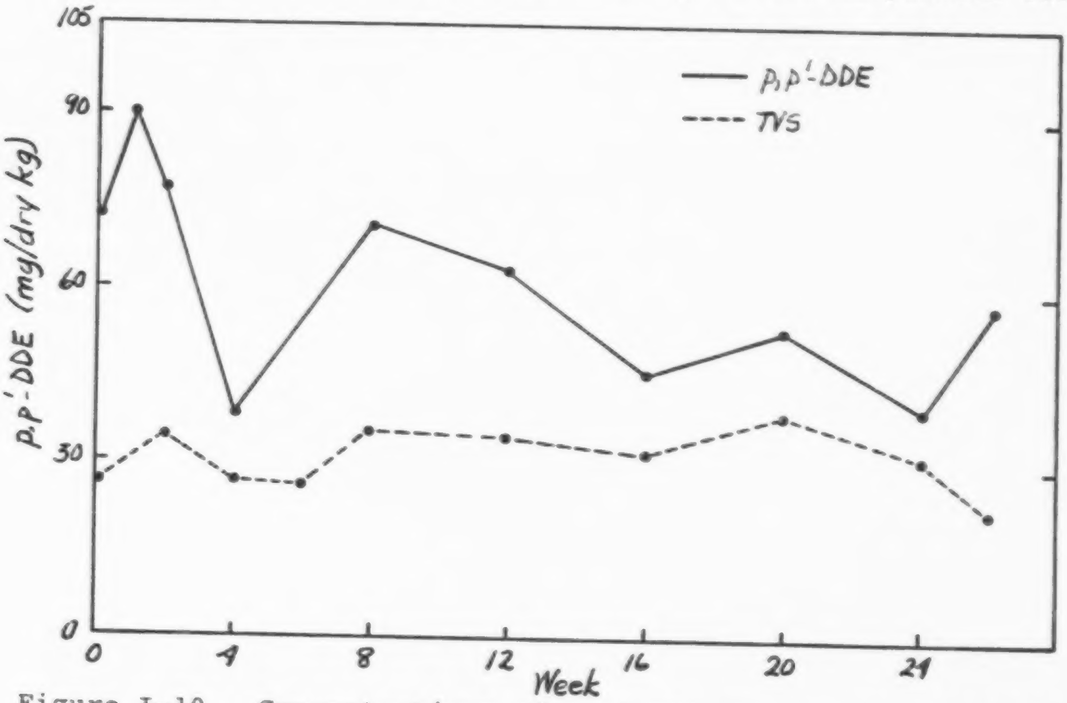


Figure I-10. Concentrations of p,p'-DDE and TVS in anaerobic station 7C sediments measured during aerobic agitation desorption test (T=12°C).

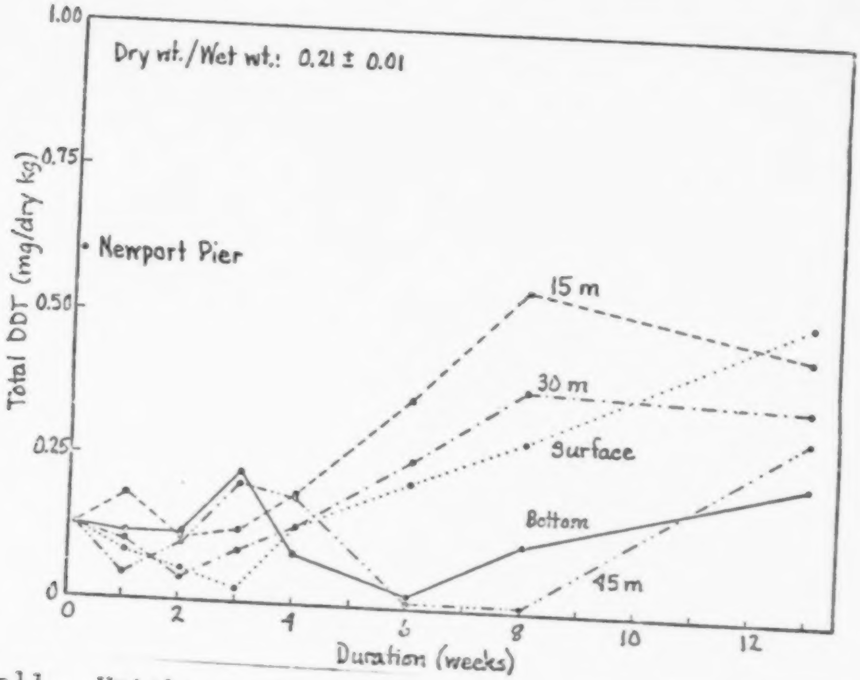


Figure I-11. Uptake curves for total DDT in mussels (M. californianus) translocated in January 1976 from Point Sal to the OCSD outfall buoy system.

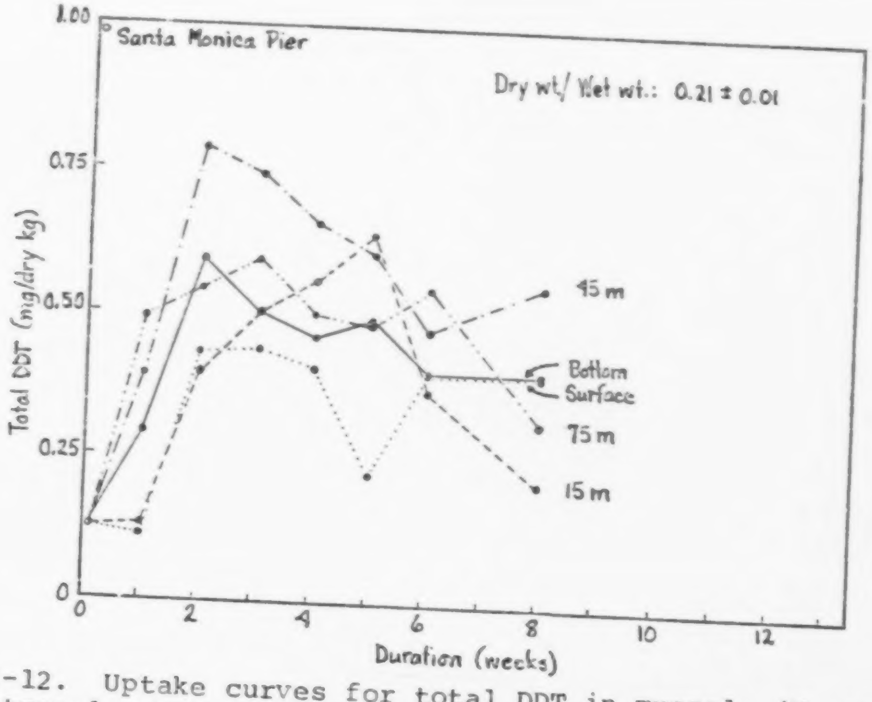


Figure I-12. Uptake curves for total DDT in mussels (M. californianus) translocated in January 1976 from Point Sal to the Hyperion 7-mile outfall buoy system.

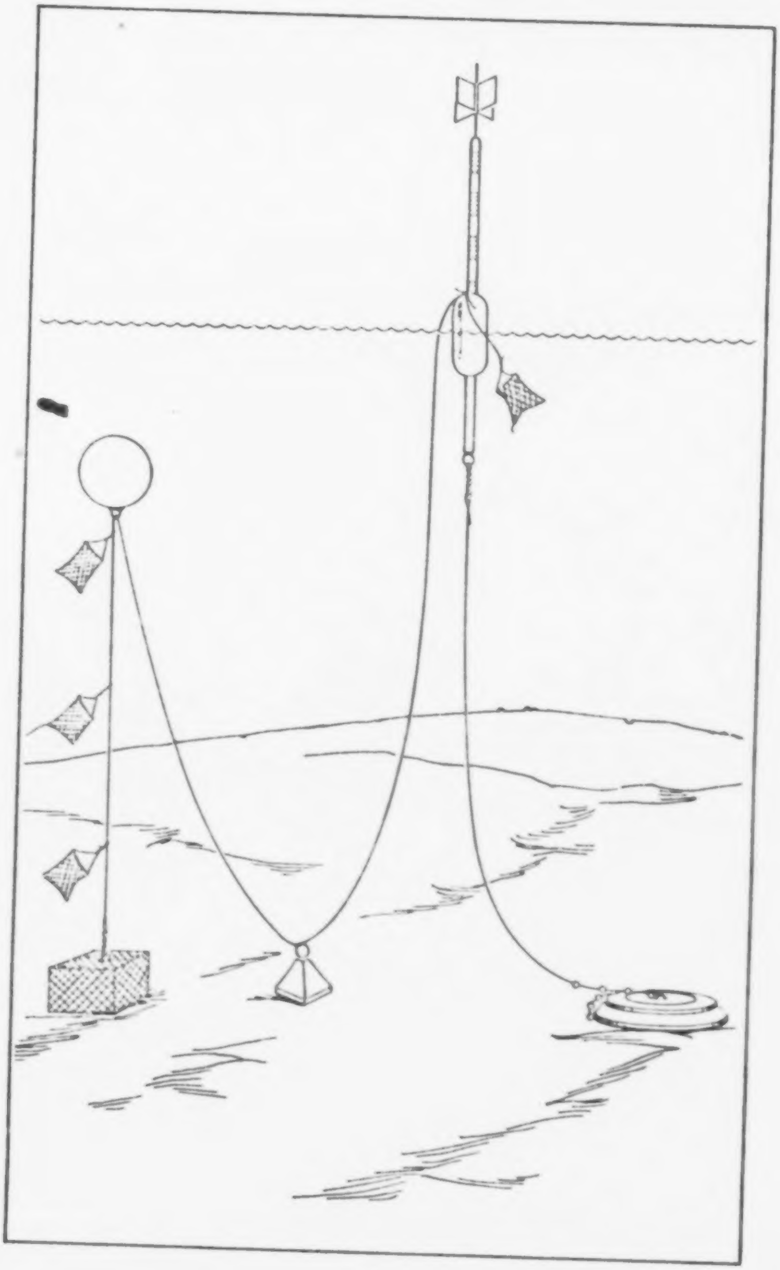


Figure I-13. Taut-line buoy system used to maintain filter-feeding mussels at various levels in outfall discharge zones.

APPENDIX J
HCB IN WASTEWATER

Table J-1 summarizes tentative quantifications of hexachlorobenzene measured by electron capture gas chromotography in major municipal wastewaters discharged during 1974-75 to the Southern California Bight. The spring 1974 analyses were conducted at Bodega Marine Laboratory by SCCWRP consultants B. de Lappe and Dr. R. Risebrough, who first pointed out the possible occurrance of HCB in southern California municipal wastewaters.

TABLE J-1

Tentative HCB concentrations (μg/l) in municipal wastewater, as measured at Bodega Marine Laboratory (BML) and in the Project Laboratory (SCCWRP). Chromatographic columns used were I (3 % OV-1), II (5 % SP-2401), III (1.5 % OV-17), and IV (1.5 % OV-17 + 1.95 % QF-1).

	BML		SCCWRP				
	Spring 1974		Fall 1974		Spring '75	Fall '75	Med.
	I	II	I	III	IV	IV	
JWPCP	0.20	0.07	0.34	0.94	0.41	0.25	0.30
Hyp.-5 mi.	0.01	0.002	-	-	0.07	0.01	0.01
Hyp.-7 mi.	3.7	0.12	4.7	2.1	1.9	6.8	2.9
OCSD	0.34	0.09	0.05	0.06	0.04	-	0.06
Pt. Loma	0.13	0.05	<0.003	0.10	<0.01	0.01	0.03
Oxnard	0.06	0.03	-	0.06	0.35	0.04	0.06

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